L	T	P	C
3	1	0	4

Course Code: CSE407R01
Semester: VII

CLOUD COMPUTING

Course Objective:

This course will help the learner to understand the various models, cloud technologies, the role of virtual machines and containers. Also, the learner will explore the importance of Cloud for analytics, machine learning, mobile computing and IOT with highlights on security challenges, and will acquire knowledge on applications of cloud computing in various fields with case studies.

UNIT - I   **15 Periods**

Foundation of Cloud Computing: Introduction - Cloud computing characteristics - Advantages and disadvantages - Comparison of traditional and cloud computing paradigms - Future of the cloud. **Cloud Services and Deployment Models:** Types of Cloud - Infrastructure-as-a-Service - Platform-as-a-Service - Software-as-a-Service. **Managing data in the cloud: Storage as a Service:** Storage Models - The Cloud Storage Landscape - Access Methods: Portals and APIs - Amazon Cloud Storage Services - Microsoft Azure Storage Services - Google Cloud Storage Services.

UNIT - II   **15 Periods**

Computing in the Cloud: Computing as a Service: Virtual Machines and Containers - Advanced Computing Services - Serverless Computing - Pros and Cons of Public Cloud Computing. **Using and Managing Virtual Machines:** Historical Roots - Amazon's Elastic Compute Cloud - Azure VMs - Google Cloud VM Services - Jetstream VM Services. **Using and Managing Containers:** Container Basics - Docker and the Hub - Containers for Science - Creating Your Own Container. **Scaling Deployments:** Paradigms of Parallel Computing in the Cloud - SPMD and HPC-style Parallelism - Many Task Parallelism - MapReduce and Bulk Synchronous Parallelism - Graph Dataflow Execution and Spark - Agents and Microservices - HTCondor.

UNIT - III   **15 Periods**

The Cloud as Platform: Data Analytics in the Cloud: Hadoop and YARN - Spark - Amazon Elastic MapReduce - Azure HDInsight and Data Lake - Amazon Athena Analytics - Google Cloud Datalab. **Machine Learning in the Cloud:** Spark Machine Learning Library - Azure Machine Learning Workspace - Amazon Machine Learning Platform - Deep Learning: Introduction - Amazon MXNet Virtual Machine Image - Google TensorFlow in the Cloud - Microsoft Cognitive Toolkit. **Wireless Internet and Mobile Cloud Computing:** - Mobile Devices and Internet Edge Networks - Wi-Fi, Bluetooth, and Wireless Sensor Networks - Cloudlet Mesh for Mobile Cloud Computing - Mobile Clouds and Colocation Clouds.

UNIT - IV   **15 Periods**

IoT Sensing and Interaction with Clouds: Local and Global Positioning Systems - Cloud- Based RAN for Building Mobile Networks - IoT Interaction Frameworks with Clouds and Devices. **Cloud Computing in Social Media Applications:** Social Media Big-Data Industrial Applications - Social Networks and API for Social Media Applications - Social Graph Properties and Representations -

Social Graph Analysis on Smart Clouds. **Multicloud Mashup Architecture and Service:** Cloud Mashup Architecture for Agility and Scalability - Multicloud Mashup Service Architecture - Skyline Discovery of Mashup Services - Dynamic Composition of Mashup Services. **Security and Privacy:** Thinking about Security in the Cloud - Role-based Access Control - Secure Data in the Cloud - Secure Your VMs and Containers - Secure Access to Cloud Software Services. **Applications and Case studies:** Cloud computing in education, healthcare, politics, business, agriculture - Cloud computing adoption in Sub-Saharan Africa - Cloud computing adoption in India.

TEXT BOOKS

1. Hiran KK, Doshi R, Fagbola T, Mahrishi M. *Cloud computing: Master the Concepts, Architecture and Applications with Real-world Examples and Case Studies*, BPB Publications, 2019.
2. Foster I, Gannon DB. *Cloud Computing for Science and Engineering*. MIT Press, 2017.
3. Hwang K. *Cloud Computing for Machine Learning and Cognitive Applications*, MIT Press, 2017.

REFERENCES

1. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter. *Cloud Computing: A Practical Approach*, McGraw Hill, 2010.
2. Dinkar Sitaram and Geetha Manjunat. *Moving To The Cloud: Developing Apps in the New World of Cloud Computing*, Elsevier, 2012.

ONLINE MATERIALS

1. https://nptel.ac.in/courses/106104182
2. https://archive.nptel.ac.in/courses/106/105/106105167/

UNITWISE LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to

Unit I	Gain an insight into service, deployment models and storage as a service
Unit II	Explore an idea on computing as a service, management of virtual machines, containers and scaling deployment
Unit III	Know how cloud computing can be a platform with regard to Data Analytics, Machine Learning and Mobile networks
Unit IV	Learn the integration of cloud computing with IOT, Social Media and apply the concepts in various case studies

COURSE LEARNING OUTCOMES

Upon successful completion of this course, the learner will be able to

CO No.	Course Outcomes	Knowledge Level
1	Distinguish various cloud services and deployment models	K4
2	Explain the various ways of storing and accessing the data from the service provider's perspective	K3
3	Identify the differences between virtual machine and the container and explore various VM services	K4

4	Examine the various approaches of parallelism for scalable deployment	K4
5	Evaluate how cloud computing can be used as a platform for data analytics, machine learning and mobile cloud.	K4
6	Explore the ways of using cloud computing as a secured platform for IOT, social media and multicloud mashup service architecture	K4