Course Code	Course Title	L	T	P	C
PMCA506L	Cloud Computing	3	0	0	3
Pre-requisite	NIL	Syllabus version			
		1.0			

Course Objectives:

1. To learn recent cloud computing paradigms and cloud infrastructures.
2. To emphasize on the understanding of virtualization and automation in a cloud environment.
3. To appreciate concepts of programming paradigms, security and storage in a cloud environment.

Course Outcomes:

1. Understand the recent cloud computing paradigms
2. Identify and relate the building blocks of cloud infrastructure
3. Understand to apply virtualization concepts and automation concepts in the cloud
4. Analyze appropriate programming approaches and tools to setup clouds
5. Explore possible ways for providing secured cloud services

Module:1	Cloud Computing Paradigms	6 hours

Evolution of Service Oriented Architecture -Web Services - Multiple Cores to Multiple Machines - Clusters to Websites and Load Balancing - Racks of Server Computers - Data Center - Multi Tenant Clouds- Concepts of Edge and Fog Computing

Module:2	Cloud Infrastructure	5 hours

Elastic Computing - Business Models for Cloud Providers - IaaS - PaaS - SaaS - Types - Private and Public Clouds- Opensource Cloud - Advantages - Hybrid Cloud - Multi Cloud- Hyperscalers - Racks, Aisles and Pods - Lights-out Data Centers - Fat Tree Designs - Scaling - Leaf - Spine Architecture - Storage in Data Center - Unified Data Center Networks.

Module:3	Virtual Machines	6 hours

Virtualization - Conceptual Organization of VM Systems - Virtual I/O Devices - Digital Objects- VM Migration - Virtual Networks, - Scaling VLANs to Data Center with VXLAN - NAT - Managing Virtualization and Mobility - Software Defined Networking

Module:4	Cloud Programming Paradigms	6 hours

MapReduce Programming Paradigm - HDFS And MapReduce - Microservices Communication Protocols Used For Microservices - Microservices Technologies, Serverless Computing Approach - Stateless Servers and Containers - Architecture of Serverless Infrastructure - DevOps Approach - Continuous Integration - Continuous Delivery.

Module:5	Orchestration	7 hours

Docker Containers - Docker Terminology and Development Tools - Docker Software Components- Kubernetes - Limits, Cluster Model, Pods - Pod Creation, Templates and Binding Times - Init Containers - Nodes and Control Plane - Control Plane Software Components- Worker Node Software Components.

Module:6	Automation	7 hours

Automation in Data Center - Levels of Automation - Plethora of Automation Tools- Automation of Manual Data Center - Evolution of automation tools - Automation with Larger Scope.

Module:7	Cloud Security and Cloud Data Storage	6 hours

Cloud Specific Security Problems - Security in Traditional Infrastructure - Zero Trust Security Model - Identity Management - Privileged Access Management - AI Technologies on Security - Protecting Remote Access - Privacy in Cloud Environment - Vulnerabilities in Cloud: Back Doors, Side Channels and Other Concerns - Managing Data in the Cloud- Storage as a Service, Using Cloud Storage Services		
Module:8	**Contemporary Issues**	**2 hours**
Guest Lecture from Industry and R&D Organizations		
	Total Lecture hours:	**45 hours**

Text Book(s)	
1.	Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", 2021, 1st Edition, CRC Press, Florida.
2	Ian Foster and Dennis B. Gannon, "Cloud Computing for Science and Engineering", 2017, 1st Edition, The MIT Press, Cambridge, Massachusetts.
Reference Books	
1.	Naresh Kumar Sehgal, Pramod Chandra P. Bhatt, John M. Acken, "Cloud Computing with Security: Concepts and Practices", 2020, 2nd Edition, Springer Nature, Switzerland.

Mode of Evaluation: CAT, Written Assignment, Quiz, FAT and Seminar

Recommended by Board of Studies	04-05-2023		
Approved by Academic Council	No. 70	Date	24-06-2023