Mukesh Patel School of Technology Management & Engineering
School of Technology Management and Engineering

Course Policy Document

Course Name - (Code): Cloud Computing (CC) – (702IT0C026)

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<tr>
<td>Program and Semester: B Tech/MBA TECH IT/CE/AI&DS/CSE(DS)/EXTC, Semester-VII</td>
<td>Pre-requisite Course: Computer Networks</td>
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<td>Academic Year: 2025-26</td>
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Credit Details:
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Pre-Course Activity: Using GenAI, explore the following: 1. What are the benefits of Cloud Computing? 2. How Data Centers evolved to Cloud Computing? 3. Identify how this course will help you in your career goals. 4. Identify the practical implementation of Cloud computing that are used by us in daily life. 5. Register on awseducate.com with your college email address	
Suggestions on tools for conducting discussion-based class activities: 1. Padlet 2. Mentimeter	

1. Introduction to the Course

1.1 Importance of the Course

1.1.1 **Domain** Relevance**:**

Computer Science engineering is a fundamental discipline that deals with the study of computers and their applications. The course on Cloud Computing is relevant to this domain as it focuses on practical-oriented, application-based learning. The increasing adoption of Cloud across all domains makes it essential for Computer Science students to understand the concepts and technologies involved in Cloud Computing.

1.1.2 **Industry** Relevance**:**

As costs and requirements of resources are increasing, companies are adopting Cloud to reduce their expenses and improve efficiency. This shift from centralized data centers to distributed Cloud architecture has significant implications for industries that rely heavily on technology and data storage. Understanding Cloud Computing is crucial for students to be industry-ready and competitive in the job market.

1.2 Objectives of the Course:

- Understand state-of-the-art cloud computing technologies and applications
- Learn basic models, architecture, and virtualization concepts
- Study concepts, processes, and best practices needed to secure cloud information
- Emphasize on business models and risk management aspects of cloud computing
- Focus on service management aspects of cloud computing.

2. Vision & Mission

2.1 Vision:

Information Technology department envisages to be the centre of excellence in IT education that empowers the students with versatile knowledge and practical skills to excel in all their endeavours. The department aspires to become a leading hub for technological advancement and societal impact in the long term.

2.2 Mission:

- Provide comprehensive education in Information Technology, emphasizing practical skills and hands-on experience, to prepare students for diverse career paths in the IT industry.
- Cultivate an environment that fosters creativity, ethical values, and entrepreneurial spirit, promoting the development of innovative solutions.
- Encourage research initiatives in Information Technology, enabling collaboration between academia and industry to address contemporary challenges and contribute to technological advancement.
- Facilitate continuous learning and professional development in emerging technologies, enabling students to adapt to evolving IT landscapes and pursue lifelong learning opportunities.

3. Course Outcomes (CO), Mapping with Program Outcomes (PO), and Program Specific Outcomes (PSO)

3.1 Course Outcomes

CO1: Classify the layers of cloud reference model based on their significance

CO2: Address security concerns and orchestration in cloud environment

3.2 Program Outcomes (PO) the course contributed to:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusion.

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one’s own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i)Independent and life-long learning ii) Adaptability to new and emerging technologies and iii) Critical thinking in the broadest context of technological change.

3.3 Program Specific Outcomes (PSO):

3.3.1 PSO-1: Demonstrate an ability to visualize, architect and create appropriate solutions for IT related projects.

3.3.2 PSO-2: Demonstrate an ability to professionally manage, monitor and safeguard IT resources.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	1	2	3		1			2				1	
CO2	2	1	2		2			1					1

Mapping Levels: 1- High, 2-Medium, 3-Low

3.4 Student Outcomes (SO) (For ABET accredited Programs):

3.4.1 SO-1: Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

3.4.2 SO-2: Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.

3.4.3 SO-3: Communicate effectively in a variety of professional contexts.

3.4.4 SO-4: Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.

3.4.5 SO-5: Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

3.4.6 SO-6: Identify and analyze user needs and to take them into account in the selection, creation, integration, evaluation, and administration of computing-based systems.

4. Detailed Syllabus

Detailed Syllabus		
Unit	**Description**	**Duration**
1	**Introduction to Cloud** Essential Characteristics of Cloud, Cloud Service Models, Cloud Deployment Models, Cloud Service Brokerage, Cloud Reference Model, Considerations for building Cloud Infrastructure	5
2	**Physical Layer** Compute System, Storage System Architecture, Network Connectivity	5
3	**Virtual Layer** Virtual Layer Functions, Virtualization Software, Resource Pool and Virtual Resources	5
4	**Control Layer** Control Layer Functions, Control Software, Resource Optimization Techniques	5
5	**Cloud Security** Threats, Security Mechanisms, IAM solutions, Security Algorithms	5
6	**Orchestration** Container Approach, Docker Container, Items in a Dockerfile, Kubernetes Pods, Kubernetes Terminology, Kubernetes Cluster Model, Kubernetes Features	5
	Total	**30**

5. Teaching-learning methodology

5.1 Instruction Plan

Lecture No.	Topic	Teaching Method	Blooms Level	Resources	COs mapped	Assessment and Evaluation
Unit 1: Introduction to Cloud						
1	Essential characteristics of Cloud	PPT, Whiteboard	UNDERSTAND	T1	CO1	Class Test-1 and TEE
2	Cloud Service Models		UNDERSTAND	T1	CO1	

3	Cloud Deployment Models, Cloud Service Brokerage		UNDERSTAND	T1	CO1	
4	Cloud Reference Model		APPLY	T1	CO1	Lab Submission and Class Test-1 and TEE
5	Considerations for building Cloud Infrastructure		UNDERSTAND	T1	CO1	Class Test-1 and TEE
Unit 2: Physical Layer						
6	Physical Layer and its overview	PPT, Whiteboard	UNDERSTAND	T1	CO2	Lab Submission and Class Test-1 and TEE
7	Compute System		UNDERSTAND	T1	CO2	
8	Storage System Architecture, RAID level, Parity, Mirroring Data Access Methods		UNDERSTAND	T1	CO2	
9	Block Storage File-based Storage Object Storage		APPLY	T1	CO2	
10	IP SAN, iSCSI, FCIP, FCoE SAN		APPLY	T1	CO2	
Unit 3: Virtual Layer						
11	Introduction to Virtualization	**Flipped Classroom** (Video resources can be provided)	UNDERSTAND	T1	CO2	Lab Submission and Class Test-1 and TEE
12	Virtual Layer Functions		UNDERSTAND	T1	CO2	
13	Role of Hypervisor	PPT, Whiteboard	APPLY	T1	CO2	Lab Submission and Class Test-2 and TEE

14	Type of Hypervisors		APPLY	T1	CO2	
15	Resource Pooling and Virtual Resources		UNDERSTAND	T1	CO2	
Unit 4: Control Layer						
16	Introduction to Control Layer	PPT, Whiteboard	UNDERSTAND	T1	CO2	Lab Submission and Class Test-2 and TEE
17	Functions of Control Layer		UNDERSTAND	T1	CO3	
18	Resource Discovery and Provisioning, Software Defined Controller		APPLY	T1	CO3	
19	Hyperthreading, VM Load Balancing across Hypervisors, Cache tiering, QoS, Traffic Shaping	PPT, Whiteboard	APPLY	T1	**CO3**	
20	Resource Optimization Techniques		UNDERSTAND	T1	**CO3**	
Unit 5: Cloud Security						
21	Key Security threats in Cloud	PPT, Whiteboard	UNDERSTAND	T2	**CO3**	Lab Submission and Class Test-2 and TEE
22	Key Security Mechanisms, DMZ, Physical Security		UNDERSTAND	T2	**CO3**	Lab Submissions and TEE
23	Identity and Access Management		UNDERSTAND	T2	**CO3**	
24	OAuth, MFA		APPLY	T2	**CO4**	

25	Kerberos, OpenID Connect		APPLY	T2	**CO2**	
Unit 6: Orchestration						
26	Introduction to Orchestration	PPT, Whiteboard	UNDERSTAND	T2	**CO4**	Lab Submissions and TEE
27	Container Approach, How does it work?		APPLY	T2	**CO4**	
28	Docker Containers, Items in a Dockerfile	PPT, Whiteboard, TPS	APPLY	T2	**CO4**	
29	Kubernetes Terminology, Kubernetes Pods	PPT, Whiteboard	APPLY	T2	**CO4**	
30	Kubernetes Cluster Mode, Kubernetes Features	PPT, Whiteboard, Flipped Classroom	APPLY	T2	**CO4**	

6. Assessment and Evaluation Scheme

	Internal Continuous Assessment (ICA) (50 Marks)				
	Class Tests (20 Marks)		**Term-work (30 Marks)**		
Assessment Component	Class Test-1	Class Test-2	Lab Submissions	Assignments/ Review paper	Challenging Problems/ Presentation on given topic
Marks	10	10	10	10	10

6.1 Internal Continuous Assessment (ICA) – 50 marks

Class Test-1 conducted in the 6th week. It will be for 10 marks (1-hour duration). Class Test-2 conducted in the 11th week. It will be for 10 marks (1-hour duration). Lab submissions will have a weightage of 10 marks for ICA. Evaluation based on timely submissions of programming assignments given every week. In-class and home assignments or review paper on research topic given will carry a weightage of 10 marks. Evaluation based on timely submission. **50% marks would be deducted for late submissions. (It is important that all assignments and lab submissions**

are done before the deadline given). Challenging problems or presentation on given topic will carry a weightage of 10 marks.

6.2 Term End Examination (TEE) – (100 marks scaled down to 50)

TEE conducted at the end of the semester will be for 100 marks (3-hour duration). Marks obtained scaled down to 50. There will be 7 questions (each question will be 20 marks). Q1 will be compulsory and any 4 from the remaining to be solved.

6.3 Course Passing Criteria

6.3.1 ICA (50 marks) – No minimum marks

6.3.2 TEE (100 marks scaled to 50) – 40% required for passing

6.3.3 (ICA + TEE) (100 marks)

6.4 Assessments and Mapping to Course Outcomes

	Internal Continuous Assessment (ICA)					**Term End Examination (TEE)**
Course Outcomes	CT-1	CT-2	Lab Submissions	Assignments/ Review paper	Challenging Problems/ Presentation on topic	TEE
CO-1	Y	Y	Y	Y		Y
CO-2			Y	Y	Y	Y

7. Laboratory details

The following 10 programming exercises will form the submission for laboratory coursework. Each programming exercise will contain 3 to 5 programs.

Exp. No.	**Week No.#**	**Programming Topic**	**Mapped CO**
1	Week 1	Practice of Cloud Foundation like Storage, Network, Database and Compute through Account Creation for AWS Academy, AWS Educate and AWS Root Account	CO1

1.	Week 2	**Instructor-led Activity: Examining IAM Policies** Guided Lab: Exploring AWS Identity and Access Management (IAM)	CO1
2.	Week 3	**Instructor-led Activity: Designing with Amazon S3 Assignment** Challenge (Cafe) lab: Creating a Static Website for the Cafe	CO1
3.	Week 4	**Instructor-led Activity: Choosing Instance Types External Tool** Guided lab: Introducing Amazon Elastic File System (Amazon EFS) Challenge (Cafe) lab: Creating a Dynamic Website for the Café	CO1
4.	Week 5	**Database Layer** Guided lab: Creating an Amazon RDS Database Challenge (Cafe) lab: Migrating a Database to Amazon RDS	CO1
5.	Week 6	**Networking Layer** Guided lab: Creating a Virtual Private Cloud Challenge (Cafe) lab: Creating a VPC Networking Environment for the Café	
6.	Week 7	**Connecting Networks** Guided lab: Creating a VPC Peering Connection	CO1
7.	Week 8	**Securing User, Application, and Data Access** Guided lab: Securing Applications by using Amazon Cognito Guided lab: Encrypting Data at Rest by Using AWS Encryption Options	CO2
8.	Week 9	**Implementing Monitoring, Elasticity, and High Availability** Guided lab: Creating a Highly Available Environment Challenge (Café) lab: Creating a Scalable and Highly Available Environment for the Café	CO2
9.	Week 10	**Automating Your Architecture** Guided lab: Automating Infrastructure with AWS CloudFormation Challenge (Café) lab: Automating Infrastructure Deployment	

10.	Week 11	**Building Decoupled Architectures** Guided lab: Implementing a Serverless Architecture on AWS (Optional) Guided lab: Breaking a Monolithic Node.js Application into Microservices Challenge (Café) lab: Implementing a Serverless Architecture for the Café	
11	Week 12	Use Docker containers to run a 3-tier application	CO2

8. Tutorial Plan

This course does not have any tutorial.

9. Course Material

References and Lab Manuals would be uploaded on LMS by faculty every week.

NPTEL courses which can compliment the topics like virtualization and docker, containers and also provides practical case studies which can be helpful in assigning challenging problems to students.

https://www.cse.iitb.ac.in/~mythili/virtcc/

10. GenAI Usage

10.1 Pre-class Activity:

- Gather 5 cloud services and come up with how they are used in 3 different mobile/web applications that you use daily
- Learn about top 10 cloud services offered by AWS and their equivalent services by GCP and Azure with the help of GenAI

10.2 In-Class Activity:

1. Use GenAI to learn how to generate a Dockerfile for a simple Python application
2. Use GenAI to find understand the errors and find steps to troubleshoot them when running a container in Docker and Minikube

10.3 Assignments

GenAI is permitted to be used. Students need to cite the references used.

10.4 Challenging Problems

GenAI is permitted to be used. Students need to cite the references used.

Active learning is a method of learning in which students are actively or experientially

11. Active learning techniques

involved in the learning process. Following active learning techniques will be adopted for the course.

1. **The "One Minute Paper":** The faculty will ask students to take out a blank sheet of paper, pose a question (either specific or open-ended), and give them one (or perhaps two - but not many) minute(s) to respond.
2. **Blended Learning:** Students will be introduced to the topic at home while the in-depth topics, applications and numerical problems will be discussed by the faculty in the lecture session. Outline for preliminary study to be done for each unit will be provided prior to commencement of each unit. Preliminary study material (video links, presentation, notes etc) will be made available on the student portal.
3. **Brainstorming:** Students will be asked to generate ideas on a certain topic, category or question while the faculty will facilitate and record the answers on the blackboard/whiteboard.
4. **Problem Based learning:** Students will be asked to provide solutions to certain topic involving real life problems with help of case studies. Case study discussion and appropriate path selection will be done to elicit students thinking.

12. Academic Integrity Statement

Original work expected from students for all the **assigned assessment work**. Copying in any form not acceptable and will invite strict disciplinary action. Evaluation of corresponding component will be affected proportionately in such cases. Plagiarism detection software will be used to check plagiarism wherever applicable. Academic integrity is expected from students in all components of course assessment**.**