



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Information Technology

Subject Code: DI05016031

Subject Name: Cloud and Data Center Technology

w. e. f. Academic Year:	2026-27
Semester:	5 th
Category of the Course:	PEC-III

Prerequisite:	Students are expected to have a basic understanding of computer systems, operating systems, and networking fundamentals. Familiarity with databases and basic programming concepts is beneficial for better comprehension. Prior exposure to web technologies can further support understanding of cloud-based services.
Rationale:	This course equips students with the foundational knowledge required in cloud computing and data center technologies. It highlights key advantages such as virtualization, enhanced security, and global accessibility, which collectively make these technologies integral to modern IT infrastructure. These capabilities enable organizations to effectively respond to rapidly evolving technological demands. Upon completion of the course, students will be able to understand various cloud service and deployment models, implement security mechanisms, design and manage data centers, apply virtualization techniques, utilize cloud storage and database services, and explore as well as implement emerging technologies within the domain of cloud computing.

Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
01	Understand the concept of Cloud architecture and its model.	Understand
02	Apply the virtualization concept with its types.	Apply
03	Understand Data Center Architecture.	Understand
04	Learn and use Cloud Storage and Database Services.	Apply
05	Explain Cloud Security and Compliance.	Apply
06	Understand and implement emerging technologies with Cloud Computing.	Apply

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to cloud computing 1.1 Trends in computing 1.1.1 Distributed Computing 1.1.2 Grid Computing 1.1.3 Cluster Computing 1.1.4 Utility Computing 1.1.5 Cloud Computing 1.2 Define Cloud Computing 1.2.1 Define cloud computing 1.2.2 Characteristics of Cloud Computing 1.2.3 Roots of cloud computing 1.3 Cloud Service Model 1.3.1 Cloud Architecture and Platforms 1.3.2 IaaS 1.3.3 Paas 1.3.4 SaaS 1.4 Deployment Models 1.4.1 Private cloud 1.4.1 Community cloud 1.4.1 Public cloud 1.4.1 Hybrid cloud 1.5 Desired Features of a Cloud	04	08



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	1.6 Pros and Cons of Cloud computing 1.7 Applications of cloud computing		
2.	Virtualization and Hypervisors 2.1 Introduction to Cloud virtualization 2.2 Characteristics and overview of virtualization 2.3 Types of Cloud Virtualization 2.3.1 Hardware virtualization 2.3.2 Software Virtualization 2.3.3 Full virtualization 2.3.4 Para virtualization 2.3.5 Partial virtualization 2.3.6 Operating system level virtualization 2.4 Hypervisors and Virtual Machines 2.4.1 Introduction to Hypervisors(Type 1 and Type2) 2.4.2 Creating and managing Virtual Machines 2.5 Virtualization of Clusters and data centers automation	09	20
3.	Data Center Architecture 3.1 Data Center Fundamentals 3.1.1 Historical perspective and evolution 3.1.2 Key components of a data center 3.2 Data Center Networking 3.2.1 Data center network topologies 3.2.2 SDN (Software-Defined Networking) in data center 3.3 Data Center Automation and Scaling 3.3.1 Automation in Data Centers 3.3.2 Infrastructure as Code (IaC) and automation tools 3.3.3 Scalability and elasticity in cloud data centers	09	20
4.	Cloud Storage and Database Services 4.1 Cloud Storage Solutions 4.1.1 Object storage, block storage, and file storage in the cloud 4.1.2 Data consistency and durability	09	20



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	4.2 Cloud Databases 4.2.1 Types of cloud databases (SQL, NoSQL) 4.2.2 Data scaling and replication		
5.	Cloud Security and Compliance 5.1. Security in the Cloud 5.1.1 Cloud security challenges 5.1.2 Identity and access management 5.1.3 Access control and authentication in cloud computing 5.2. Data Security in Cloud 5.2.1 Technologies for Data Security in Cloud 5.3. Securing Private and Public Cloud Architecture 5.3.1 Metrics for Service Level Agreements(SLAs) 5.3.2 DevSecOps	06	14
6.	Emerging Technologies with Cloud Computing 6.1 Mobile cloud computing (MCC) 6.2 Sensor and IOT cloud 6.3 Serverless Computing 6.4 Edge and Fog Computing 6.5 AI and Machine Learning with Cloud Computing 6.6 Distributed Ledger Technology (DLT) with Cloud computing 6.7 5G and Cloud-Native Networking 6.8 Kubernetes and Containers	08	18
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	40	40	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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References/Suggested Learning Resources:

(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Cloud computing, Principles and Paradigm	Rajkumar Buyya, J. Broberg, A. Goscinski	John Wiley & Sons, Inc. Publication, ISBN: 978-0-470-88799-8
2	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi	McGraw Hill Publication ISBN: 978-1-25-902995-0
3	Cloud Computing Bible	Barrie Sosinsky	Wiley Publishing, Inc. ISBN: 978-0-470-90356-8
4	Cloud Computing: A Practical Approach	Anthony T. Velte, Toby J. Velte, Robert Elsenpeter	McGraw Hill Publication ISBN: 978-0-07-068351-8
5	Cloud Data Centers and Cost Modeling A Complete Guide To Planning, Designing and Building a Cloud Data Center	Caesar Wu, Rajkumar Buyya	Elsevier Science ISBN: 978-0-12-801413-4

(b) Open-source software and website:

1. <https://archive.nptel.ac.in/courses/106/105/106105167/>
2. <https://www.openstack.org/>
3. <https://www.virtualbox.org/>
4. <https://www.vmware.com/in.html>
5. <http://mininet.org>
6. <https://cloudsimapp.com/>
7. <https://www.docker.com/products/docker-scout/>
8. Introduction to Docker Containers and Kubernetes
<https://www.youtube.com/watch?v=w1wNjVyv4r8>



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Suggested Course Practical List:

The following practical outcomes (PrOs) are the subcomponents of the COs. These PrOs need to be attained to achieve the COs.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1.	Sketch out and analyze the architecture of Openstack/ Eucalyptus/ OpenNebula/ KVM and identify different entities to understand the structure of it.	I	2
2.	Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud softwares like Openstack/ Eucalyptus/ OpenNebula with Rolebased access control.	I	4
3.	Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different platforms of Linux or Windows OS on top of windows 8 and above.	II	2
4.	Create desktop Virtualization using Chrome Remote Desktop.	II	4
5.	Setup your own virtual SDN lab using any of below given platform i) Virtualbox/Mininet Environment for SDN - http://mininet.org	III	4
6.	A study and comparison on various cloud databases like Amazon RDS ,Google Cloud SQL,Microsoft Azure SQL Database, IBM Db2 on Cloud, Firebase Realtime Database (NoSQL), MongoDB Atlas (NoSQL),Oracle Cloud Autonomous Database	IV	4
7.	A study and comparison on various cloud storage like Amazon S3,Google Cloud Storage, Microsoft Azure Blob Storage, IBM Cloud Object Storage for its performance and scalability	IV	2
8.	Simulate a secure file sharing using a cloudsims open-source framework	V	2
9.	To implement secure object storage with access control and encryption using an open-source cloud storage platform.	V	2
10.	Creating and Executing Your First Container Using Docker platform.	VI	4



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	Total	30
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Note :- More Practical Exercises can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.

List of Laboratory/Learning Resources Required:

Sr. No.	Laboratory/Learning Resources/Equipment Name with Broad Specifications	PrO. No.
1	Computer system with operating system: Windows 7 or higher Ver., macOS, and Linux, with 4GB or higher RAM	All
2	Virtualbox/VMware , Cloudsim, NetBeans, Eclipse .	

Sample Projects: (if required)

- Create a cloud-based web/mobile application.
- Prepare the report on case study of Amazon Cloud Services/Google Cloud.
- Host a static website using AWS or any other clouds.

Suggested Activities for Students: (if required)

Beyond classroom and laboratory learning, the following student-centered co-curricular activities are recommended to enhance the attainment of course outcomes. Students are expected to perform these activities in groups and prepare a report of approximately five pages for each activity. Additionally, they should collect and document appropriate physical evidence for inclusion in their professional portfolio, which will be beneficial during placement interviews:

- Explore and analyze application development across various cloud computing domains.
- Undertake team-based micro-projects related to course concepts.
- Deliver seminars on relevant and emerging topics in the field.

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