



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Cyber Security

Course / Subject Code : ME02059051

Course / Subject Name : Cloud Computing Security

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Fundamental of computer networks, OS fundamentals, Concepts of virtualization, Programming language basics, Concepts of system architecture.
Rationale:	<ul style="list-style-type: none"> The course on cloud computing and security introduces the basic concepts of Cloud Computing as well as security systems and cryptographic protocols, which are widely used in the design of cloud security. The course is also focused upon the security issues related to multi-tenancy operation, virtualized infrastructure and environment of security and methods to improve virtualization security are also dealt with in this course.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the need and various layers of cloud infrastructure.	U
02	Make use of modern security concepts in cloud computing.	A
03	Analyze the security of virtual systems.	A
04	Examine the cloud forensics challenges.	E
05	Assess compliance issues that arise from cloud computing.	E

*Revised Bloom's Taxonomy (RBT)

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 / CA (M)	PA/CA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1	UNIT I: Cloud Computing Fundamentals: Definition of Cloud Computing, Cloud Deployment Models: Public, Private, Hybrid and Community Cloud, Service Models: SaaS, PaaS and IaaS, Business Agility: Benefits, Risks and challenges to Cloud architecture. Application availability, performance, security and disaster recovery in cloud, next generation Cloud Applications.	05	10
2	UNIT II: Concepts of Security: CIA Triad (Confidentiality, integrity, availability), privacy, authentication, non-repudiation, access control, defense in depth, least privilege, how these concepts applicable in the cloud, their importance in PaaS, IaaS and SaaS. e.g., User authentication in the cloud; Cryptographic Systems Symmetric cryptography, stream ciphers, block ciphers, modes of operation, public-key cryptography, hashing, digital signatures, publickey infrastructures, key management, X.509 certificates, OpenSSL.	04	05
3	UNIT III: Multi-Tenancy Issues: Isolation of users/VMs from each other, How the cloud provider can provide this; Virtualization System Security Issues- e.g., ESX and ESXi Security, ESX file system security, storage considerations, backup and recovery; Virtualization System Vulnerabilities- Management console vulnerabilities, management server vulnerabilities, administrative VM vulnerabilities, guest VM vulnerabilities, hypervisor vulnerabilities, hypervisor escape vulnerabilities, configuration issues, malware (botnets etc.)	08	20
4	UNIT IV: Virtualization System Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyper jacking, Kubernetes.	08	20
5	UNIT V: Data Protection for Cloud Infrastructure and Services: Understand the Cloud based Information Life Cycle, Data protection for Confidentiality and Integrity, Common attack vectors and threats, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key Management, assuring data deletion, Data retention, deletion and archiving procedures for tenant Data Protection Strategies.	06	15



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6	UNIT VI: Cloud Forensics: Cloud Computing Forensic Science Challenges, Confiscation of Cloud resources, Legal challenges and standards, Challenges with location, data and logs, Live Forensics, Artifacts gathering from cloud computing, log management, Cloud forensics research & development work.	07	15
7	UNIT VII: Legal and Compliance Issues: Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern Security Standards (e.g., PCIDSS, FISMA, NIST 800), how standards deal with cloud services and virtualization, compliance for the cloud provider vs. compliance for the customer.	07	15
TOTAL		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
00	20	30	30	20	00

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

References/Suggested Learning Resources:

(a) Books:

1. Tim Mather, SubraKumaraswamy, ShahedLatif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance" O'Reilly Media; 1 edition [ISBN: 0596802765], 2009.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" [ISBN: 0470589876], 2010.
3. Handbook of Cloud Computing, BorkoFurht, Armando Escalante, Springer, 2010.

(b) Open-source software and website:

1. Course-related online MOOC on SWAYAM NPTEL/Coursera Platform.
2. Recently published papers/articles of reputed journals/conferences.s

Suggested Course Practical List:

- List of Laboratory/Learning Resources Required: The practical work will be carried out based on the content covered during the academic sessions.

List of Laboratory/Learning Resources Required:

Suggested Project List: Creation of local projects.
