Lovely Professional University, Punjab

Course Code	Course Title	Lectures	Tutorials	Practicals	Credits	
CSE423	VIRTUALIZATION AND CLOUD COMPUTING	3	0	0	3	
Course Weightage	ATT: 5 CA: 25 MTT: 20 ETT: 50	**Exam Category: 11: Mid Term Exam: All MCQ – End Term Exam: All MCQ**				

Course Focus	EMPLOYABILITY,SKILL DEVELOPMENT,ENTREPRENEURSHIP

Course Outcomes :Through this course students should be able to

CO1 :: illustrate the main aspects, essential technologies, mechanisms of Virtualization technology and key concepts of distributed computing.

CO2 :: identify the appropriate technologies, algorithms and approaches for the provisioning of various resources and implementation of cloud computing

CO3 :: understand the major concerns associated with cloud computing such as cloud architecture, service oriented architecture, capacity planning and service level agreement.

CO4 :: estimate the economical cloud solution and issues by considering suitable cost estimation strategy and laws of cloudonomics

CO5 :: enumerate the fundamental aspects of cloud security, risks related to cloud and demonstrate the use of cloud database.

CO6 :: understand the emerging technologies of cloud computing, authentic cloud platform and how it bring changes in the traditional cloud computing models

	TextBooks (T)		
Sr No	**Title**	**Author**	**Publisher Name**
T-1	CLOUD COMPUTING (FUNDAMENTALS,INDUSTRY APPROACH AND TRENDS	RISHABH SHARMA	WILEY

	Reference Books (R)		
Sr No	**Title**	**Author**	**Publisher Name**
R-1	MASTERING CLOUD COMPUTING	RAJKUMAR BUYYA,CHRISTIAN VECCHIOLA ,S.THAMARAI SELVI	MCGRAW HILL EDUCATION
R-2	CLOUD COMPUTING: A HANDS-ON APPROACH	ARSHDEEP BAHGA, VIJAY MADISETTI	UNIVERSITIES PRESS PVT. LTD

Other Reading (OR)	
Sr No	**Journals articles as Compulsary reading (specific articles, complete reference)**
OR-1	https://www.hitechnectar.com/blogs/distributed-vs-parallel-computing/ ,

Relevant Websites (RW)		
Sr No	**(Web address) (only if relevant to the course)**	**Salient Features**
RW-1	https://inst.eecs.berkeley.edu/~cs61a/su12/lec/notes/communication.html	Detailed notes on Distributed and Parallel computing
RW-2	https://www.google.co.in/books/edition/Architecting_the_Cloud/NcrDAgAAQBAJ?hl=en&gbpv=1&printsec=frontcover	Architecting the Cloud, Book for reading in depth concepts
RW-3	https://www.networkacademy.io/ccna/ethernet/vlan-concept	for vlans, broadcast domains, etc
RW-4	https://stormagic.com/virtual-san-beginners-guide/	vsan
RW-5	https://www.unixarena.com/2017/12/para-virtualization-full-virtualization-hardware-assisted-virtualization.html/	types of virtualization
RW-6	https://www.baeldung.com/cs/virtualization-techniques-compared	types of virtualization
RW-7	https://www.linkedin.com/pulse/importance-using-vlans-segment-network-traffic-mike/	vlan
RW-8	https://books.google.co.in/books/about/Cloud_Computing.html?id=zqhpAgAAQBAJ&redir_esc=y	unit-2
RW-9	https://www.uniassignment.com/essay-samples/information-technology/basic-roots-of-cloud-computing-information-technology-essay.php	Roots of cloud computing
RW-10	https://www.ibm.com/cloud/learn/middleware	migration and middleware
RW-11	https://www.run.ai/guides/machine-learning-in-the-cloud#machine-learning-in-the-cloud	Machine Learning in the Cloud
RW-12	https://www.run.ai/guides/machine-learning-in-the-cloud/gpu-as-a-service#comparing	GPU as a Service
RW-13	https://www.run.ai/guides/machine-learning-in-the-cloud/ai-as-a-service	Artificial Intelligence as a Service

LTP week distribution: (LTP Weeks)	
Weeks before MTE	7
Weeks After MTE	7
Spill Over (Lecture)	

Detailed Plan For Lectures

Week Number	Lecture Number	Broad Topic(Sub Topic)	Chapters/Sections of Text/reference books	Other Readings, Relevant Websites, Audio Visual Aids, software and Virtual Labs	Lecture Description	Learning Outcomes	Pedagogical Tool Demonstration/ Case Study / Images / animation / ppt etc. Planned	Live Examples

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Week 1	Lecture 1	Overview of Distributed computing(Parallel and Distributed Systems)	T-1 R-1	RW-1 RW-2	Lecture 0 will be discussed. Discussion about subject and its conduct, discussion on distributed and parallel systems	Students will learn about how parallel and distributed systems work	Peer discussion	Instruction level parallelism
		Overview of Distributed computing(Parallel Computing, Parallel Computer Architecture)	T-1 R-1 R-2	RW-1 RW-2	Discussion about subject and its conduct, discussion on distributed and parallel systems	Students will learn about how parallel and distributed systems work	Peer discussion	Instruction level parallelism
	Lecture 2	Overview of Distributed computing(Distributed Systems)	T-1 R-1	OR-1	Discussion about subject and its conduct, discussion on distributed and parallel systems	Students will learn about how parallel and distributed systems work	Peer discussion	Working of Internet websites
		Overview of Distributed computing(Differences and Similarities among Different Types of Computing)	T-1 R-1	OR-1	Discussion about subject and its conduct, discussion on distributed and parallel systems	Students will learn about how parallel and distributed systems work	Peer discussion	Working of Internet websites
	Lecture 3	Virtualization techniques (types of virtualization)	R-1	RW-5	Discussion on Virtual machine concepts and Scenario of before virtualization , after virtualization and types of virtualization.	Students will learn about the concept of creating and configuring a virtual machine using VMware workstation.	Demonstration and hands on practice for creating a virtual machine using open source tool like VMware workstation.	Use of system resources judiciously
Week 2	Lecture 4	Virtualization techniques (virtualization technology)	T-1 R-1	RW-6	Discussion on Virtual machine concepts and Scenario of before virtualization , after virtualization and types of virtualization.	Students will learn about the concept of creating and configuring a virtual machine using VMware workstation.	Demonstration and hands on practice for creating a virtual machine using open source tool like VMware workstation.	Traditional Hardware
		Virtualization techniques (overview of x86 virtualization)	T-1 R-1 R-2	RW-6	Discussion on Virtual machine concepts and Scenario of before virtualization , after virtualization and types of virtualization.	learning about x86 machines. ALLOT TERM PAPER	Peer Discussion	Traditional Hardware
	Lecture 5	Virtualization techniques (concept of VLAN , SLAN and VSAN and benefits)	T-1 R-1 R-2	RW-3 RW-4 RW-7	Virtualization Products ,VLAN , VSAN and there benefits	Student will learn about virtualization products and Virtual LAN ,VSAN , need of interoperability and various virtualization formats	Peer Discussion	storage through network

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Week 2	Lecture 5	Virtualization techniques (concept of VLAN ,VSAN and benefits)	T-1 R-1 R-2	RW-3 RW-4 RW-7	Virtualization Products ,VLAN , VSAN and there benefits	Student will learn about virtualization products and Virtual LAN ,VSAN , need of interoperability and various virtualization formats	Peer Discussion	storage through network
	Lecture 6	Introduction to Cloud Computing(Cloud Computing in a Nutshell, Roots of Cloud Computing.)	T-1 R-1		Introduction to Cloud Computing and its applicability.	Student will learn about basics of cloud.	Peer Discussion	
Week 3	Lecture 7	Introduction to Cloud Computing(Layers and Types of Clouds.)	T-1 R-2	RW-9	Introduction to Cloud Computing and its applicability.	Student will learn about basics of cloud.	Peer Discussion	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive for storage.
		Introduction to Cloud Computing(Desired Features of a Cloud, Cloud Infrastructure Management.)	T-1 R-1	RW-9	Introduction to Cloud Computing and its applicability.	Students will learn about the concept of virtualization and its different categories along with the applications. This will help the students to know about the differentiation between type 1 and type 2 virtualization. Along with this student will also learn about basics of cloud.	Demonstration and hands on practice for the implementation of type 2 virtualization using hypervisor software.	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive for storage.
	Lecture 8	Introduction to Cloud Computing(Examining the Characteristics of Cloud Computing)	T-1 R-1	RW-8	Define Cloud computing and cloud types	Students will learn basics of cloud computing and its various types of models	Peer Discussion	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive for storage.

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Week 3	Lecture 8	Introduction to Cloud Computing(cloud types)	T-1 R-1	RW-8	Define Cloud computing and cloud types	Students will learn about the concept of virtualization and its different categories along with the applications. This will help the students to know about the differentiation between type 1 and type 2 virtualizations. Along with this students will also learn basics of cloud computing and its various types of models	Demonstration and hands on practice for the implementation of type 2 virtualization using hypervisor software.	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive for storage.
	Lecture 9	Migrating into a Cloud (Broad Approaches to Migrating into the Cloud)	T-1 R-2		Discussion on moving from traditional server concept to cloud practices	Students will learn about cloud migration	Peer Discussion	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive for storage.
Week 4	Lecture 10	Migrating into a Cloud(The Seven-Step Model of Migration into a Cloud VM Migration)	T-1 R-2	RW-10	Learning about migrating into cloud scenarios	Students understand migration at par	Peer discussion	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive
		Migrating into a Cloud (Cloud Middleware and Best Practices)	T-1 R-1 R-2	RW-10	Learning about migrating into cloud scenarios	Students understand migration at par	Peer discussion	Facebook, Email from yahoo, google, etc. Amazon S3 and Microsoft Sky drive
	Lecture 11	Migrating into a Cloud (Concept and Need of Cloud Middleware)	R-1 R-2	RW-10	Concepts of dtat streaming, qos and middleware responsibilities in cloud	Students will learn about various aspects of cloud model	Peer discussion, Videos	Take media broadcast case studies
		Migrating into a Cloud(QoS Issues in Cloud)	R-1 R-2	RW-10	Concepts of dtat streaming, qos and middleware responsibilities in cloud	Students will learn about various aspects of cloud model	Peer discussion, Videos	Take media broadcast case studies
	Lecture 12				Test 1			

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Week 5	Lecture 13	Migrating into a Cloud(Data Migration and Streaming in Cloud)	T-1		Cloud interoperability standards	Students will learn how interoperability works	Peer discussion, Videos, Animations	Examples of having compliance with norms
		Migrating into a Cloud (Interoperability)	T-1		Cloud interoperability standards	Students will learn how interoperability works	Peer discussion, Videos, Animations	Examples of having compliance with norms
	Lecture 14	Understanding cloud architecture(exploring the cloud computing stack)	T-1		Introduction to cloud stack and capacity planning	Understanding the cloud mechanisms	Peer discussion, Videos	
		Understanding cloud architecture(Workload distribution architecture)	T-1		Introduction to cloud stack and capacity planning	Understanding the cloud mechanisms	Peer discussion, Videos	
		Understanding cloud architecture(Capacity planning)	T-1 R-1		Introduction to cloud stack and capacity planning	Understanding the cloud mechanisms	Peer discussion, Videos	
	Lecture 15	Understanding cloud architecture(Cloud bursting architecture)	T-1 R-1	RW-8	Exploring Cloud Infrastructures (Managing the Cloud)	Students understand the cloud mechanisms	Peer Discussion	
		Understanding cloud architecture(Disk provisioning architecture)	T-1 R-1	RW-8	Exploring Cloud Infrastructures (Managing the Cloud)	Students understand the cloud mechanisms	Peer Discussion	
Week 6	Lecture 16	Understanding cloud architecture(Dynamic failure detection and recovery architecture)	T-1 R-1		Exploring Cloud Infrastructures (Managing the Cloud)	Students understand the cloud mechanisms	Peer Discussion, Animations, Videos	
	Lecture 17	Understanding cloud architecture(Cloud Computing Architecture)	R-1		Explain about Cloud computing architecture	Student will learn about Cloud computing architecture	PPts	
	Lecture 18	Understanding cloud architecture(Service Level Agreements, Service Oriented Architecture)	R-1 R-2		Explain about service level agreements and SOA	Students will learn about service level agreements and SOA. Students will be able to identify and estimate the cost expenditure when they want to take the instance subscription from any cloud vendor.	Demonstration will be given about the cloud resource price calculation using Google Pricing Calculator.	

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Week 7	Lecture 19	Understanding cloud architecture(Service Level Agreements, Service Oriented Architecture)	R-1 R-2		Explain about service level agreements and SOA	Students will learn about service level agreements and SOA. Students will be able to identify and estimate the cost expenditure when they want to take the instance subscription from any cloud vendor.	Demonstration will be given about the cloud resource price calculation using Google Pricing Calculator.	
		SPILL OVER						
Week 7	Lecture 21				Spill Over			
		MID-TERM						
Week 8	Lecture 22	Cloud Computing Technologies and Applications(Features of Meta CDN)	T-1		Explain about Meta CDN	Student will learn about Meta CDN	PPts	
	Lecture 23	Cloud Computing Technologies and Applications(Features of Meta CDN)	T-1		Explain about Meta CDN	Student will learn about Meta CDN	PPts	
	Lecture 24	Cloud Computing Technologies and Applications(Features of Meta CDN)	T-1		Explain about Meta CDN	Student will learn about Meta CDN	PPts	
Week 9	Lecture 25	Cloud Economics (Developing an Economic Strategy)	T-1		Define Cloud computing and cloud types	Students will learn more about the layers in cloud	Peer Discussion, Videos	
		Cloud Economics(Exploring the Costs)	T-1		Define Cloud computing and cloud types	Students will learn more about the layers in cloud	Peer Discussion, Videos	
	Lecture 26	Cloud Economics(Laws of cloudonomics)	T-1		Discuss cloud stack	Students will learn more about the layers in cloud	Peer Discussion, Videos	
		Cloud Economics(Cost estimation)	T-1		Discuss cloud stack	Students will learn more about the layers in cloud	Peer Discussion, Videos	
	Lecture 27	Cloud Computing Technologies and Applications(Cloud Content Delivery Network Services)	R-1 R-2		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	

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Week 9	Lecture 27	Cloud Computing Technologies and Applications(Multi-CDN)	T-1 R-1		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Machine Learning in the Cloud)	R-1 R-2	RW-11	Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Key benefits and applications of using GaaS)	R-1 R-2		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Parameters for Selecting Cloud GPU Providers)	R-1 R-2	RW-12	Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
Week 10	Lecture 28	Cloud Computing Technologies and Applications(Cloud Content Delivery Network Services)	R-1 R-2		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Multi-CDN)	T-1 R-1		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Machine Learning in the Cloud)	R-1 R-2	RW-11	Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Key benefits and applications of using GaaS)	R-1 R-2		Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	
		Cloud Computing Technologies and Applications(Parameters for Selecting Cloud GPU Providers)	R-1 R-2	RW-12	Explain about cloud content delivery network services and Multi CDN.	Students will learn about cloud content delivery network services and Multi CDN.	PPts	

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Week 10	Lecture 29	Cloud Computing Technologies and Applications(Mobile Cloud Computing)	T-1 R-1		Explain about mobile cloud computing and issues related to interCloud	Students will learn about mobile cloud computing and issues related to interCloud	PPts	
		Cloud Computing Technologies and Applications(InterCloud Issues)	R-1 R-2		Explain about mobile cloud computing and issues related to interCloud	Students will learn about mobile cloud computing and issues related to interCloud	PPts	
		Cloud Computing Technologies and Applications(Benefits and Limitations of Machine Learning in the Cloud)	R-1 R-2		Explain about mobile cloud computing and issues related to interCloud	Students will learn about mobile cloud computing and issues related to interCloud	PPts	
		Cloud Computing Technologies and Applications(Types of Cloud Based Machine Learning Services, AIaaS, GPUaaS)	R-1 R-2	RW-13	Explain about mobile cloud computing and issues related to interCloud	Students will learn about mobile cloud computing and issues related to interCloud	PPts	
	Lecture 30	Cloud security(Cloud Security Fundamentals)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Cloud Risk)	T-1 R-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Cloud Risk Division)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Policy and Organizational Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Technical Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Legal Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Other Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	

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Week 10	Lecture 30	Cloud security(Cloud Computing Security Architecture)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(VM Security Challenges)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
Week 11	Lecture 31	Cloud security(Cloud Security Fundamentals)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Cloud Risk)	T-1 R-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Cloud Risk Division)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Policy and Organizational Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Technical Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Legal Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Other Risks)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(Cloud Computing Security Architecture)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	
		Cloud security(VM Security Challenges)	T-1		Explain about the fundamentals of cloud security	Students will learn about the fundamentals of cloud security	PPts	

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Week 11	Lecture 32	Cloud Database(Operational Model for Cloud Database)	T-1		Explain about cloud database and cloud based file systems.	Students will learn about cloud database and cloud based file systems.	PPts	
		Cloud Database(Types of Cloud Database)	T-1		Explain about cloud database and cloud based file systems.	Students will learn about cloud database and cloud based file systems.	PPts	
		Cloud Database(Cloud File System)	T-1		Explain about cloud database and cloud based file systems.	Students will learn about cloud database and cloud based file systems.	PPts	
	Lecture 33	Cloud Database(Distributed File System Basics)	T-1		Discuss about the GFS and HDFS	Students will learn about the distributed file systems	PPts	
		Cloud Database(Concept of GFS and HDFS)	T-1		Discuss about the GFS and HDFS	Students will learn about the distributed file systems	PPts	
		Cloud Database(Comparison of Features)	T-1		Discuss about the GFS and HDFS	Students will learn about the distributed file systems	PPts	
Week 12	Lecture 34	Container technology (Introduction to containers)	T-1 R-1		Understanding containers	Dealing with containers	Peer discussion, Live examples	
		Container technology (container architectures)	T-1		Understanding containers	Dealing with containers	Peer discussion, Live examples	
		Container technology (Docker containers)	T-1		Understanding containers	Dealing with containers	Peer discussion, Live examples	
		Container technology (Kubernetes)	T-1		Understanding containers	Dealing with containers	Peer discussion, Live examples	
	Lecture 35				Test 2			
	Lecture 36	Cloud Platforms in Industry (Amazon Web services)	T-1 R-1		Discussion on multiple public clouds	Students will learn about the services	Peer Discussions	
		Cloud Platforms in Industry (Google App Engine)	T-1 R-1		Discussion on multiple public clouds	Students will learn about the services	Peer Discussions	
Week 13	Lecture 37	Cloud Platforms in Industry (Microsoft Azure)	T-1		Discussion on all the services in cloud	Students will understand public cloud implementations	Peer Discussion	
		Cloud Platforms in Industry (Case studies)	T-1		Discussion on all the services in cloud	Students will understand public cloud implementations	Peer Discussion	

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Week 13	Lecture 38	Other aspects of Cloud(Edge Computing)	T-1		Discussion on different computing types	Students will learn learn about different computing types	Real life examples	
		Other aspects of Cloud(Fog Computing)	T-1		Discussion on different computing types	Students will learn learn about different computing types	Real life examples	
	Lecture 39	Other aspects of Cloud(IIoT)	T-1 R-1 R-2		Discussion on new technologies in relation to Cloud	Students will learn about new technologies	Peer discussion	
		Other aspects of Cloud (Complexity in Cloud-native systems)	T-1 R-1 R-2		Discussion on new technologies in relation to Cloud	Students will learn about new technologies	Peer discussion	
Week 14	Lecture 40	Other aspects of Cloud (Green Cloud computing practices)	T-1 R-1 R-2		Discussion on new systems in cloud	Students will learn environment friendly concept of cloud	Peer Discussion	
		SPILL OVER						
Week 14	Lecture 42				Spill Over			
Week 15	Lecture 43				Spill Over			
	Lecture 44				Spill Over			
	Lecture 45				Spill Over			

Scheme for CA:

CA Category of this Course Code is:A0203 (2 best out of 3)

Component	Weightage (%)	Mapped CO(s)
Term paper	50	CO1, CO2, CO3, CO4, CO5, CO6
Test 1	50	CO1, CO2
Test 2	50	CO3, CO4

Details of Academic Task(s)

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Academic Task	Objective	Detail of Academic Task	Nature of Academic Task (group/individuals)	Academic Task Mode	Marks	Allottment / submission Week
Term paper	Student will write term paper based on learning of the course that may help in developing various new research ideas	Term paper based on relevant cloud based current and new technologies.Students will present a research paper based on the new trends in Cloud computing field. Rubrics to be followed- Requirement analysis[5 marks] Research Gap[5 marks] Literature review[10 marks] Presentation of topic[10 marks]	Individual	Online	30	2 / 10
Test 1	To evaluate the knowledge of students based on the syllabus covered	Test 1 will be of subjective type having 3 questions of 10 marks each, which includes analytical and logical scenario based questions.	Individual	Offline	30	4 / 5
Test 2	To evaluate the knowledge of students based on the syllabus covered.	Test 2 will be objective-type (MCQ based) containing 30 questions of 1 mark each. Test must have the composition of logical and analytical questions.	Individual	Online	30	11 / 12

MOOCs/ Certification etc. mapped with the Academic Task(s)

Academic Task	Name Of Certification/Online Course/Test/Competition mapped	Type	Offered By Organisation
Test 2	CLOUD COMPUTING	MOOCs	NPTL

Where MOOCs/ Certification etc. are mapped with Academic Tasks:
1. Students have choice to appear for Academic Task or MOOCs etc.
2. The student may appear for both, In this case best obtained marks will be considered.

List of suggested topics for term paper[at least 15] (Student to spend about 15 hrs on any one specified term paper)

Sr. No.	Topic
1	Cloud cryptography, Secure cloud architecture, Data segregation and recovery, Privacy in multi-tenancy clouds, Security and integrity, Load balancing, Cloud optimization, Secure data management within and across data centres, Availability, recovery and auditing, Secure computation outsourcing, Internet of things and cloud computing, Green Cloud Computing, Fog Computing, Edge Computing, Big Data and cloud computing, Cloud Storage, Cloud CDN.