Course Code	*PAD21D07J*	Course Name	CLOUD COMPUTING	Course Category	D	*Discipline Elective Course*	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Computer Applications		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	An overview of Distributed Systems and its algorithm.
CLR-2 :	To understand the concepts of Cloud Computing and Learn about various public cloud services
CLR-3 :	To explore about Web Services and Service Oriented Architecture.
CLR-4 :	To learn about Cloud Management Products, Cloud Storage and Cloud Security.
CLR-5 :	To know about Google App Engine, AWS and Azure.
CLR-6 :	To Learn about Cloud Computing Ideologies, Paradigm and its implementation.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning			Program Learning Outcomes (PLO)													
		1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
CLO-1 :	Implement various Distributed algorithms.	3	80	70	L	H	H	H	H	M	-	H	M	H	-	H	-	-	-
CLO-2 :	Use Google collaboration tools and several public cloud services.	3	85	75	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-3 :	Recognize and Implement the Levels of Virtualization.	3	75	70	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-4 :	Use security tools, finding the vulnerabilities and also to Generate a detailed report.	3	85	80	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-5 :	Install and configure Open Stack and launch VMs in AWS and Azure.	3	85	75	M	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-6 :	Gain an insight of Cloud Computing its Implementation, Management and Security.	3	80	70	M	H	H	H	H	M	-	M	M	L	-	H	-	-	-

Duration (hour)		24	24	24	24	24
S-1	SLO-1	*Introduction to Distributed Systems*	*Introduction to Cloud Computing*	*Introduction to Web Service and Service Oriented Architecture*	*Resource Provisioning and Methods*	*HDFS MapReduce*
S-2	SLO-1	*Characteristics*	*Evolution of Cloud Computing*	*SOAP – REST – Basics of Virtualization*	*Cloud Management Products*	*Google App Engine (GAE)*
S-3	SLO-1	*Issues in Distributed Systems*	*Cloud Characteristics- Elasticity in Cloud*	*Full and Para Virtualization*	*Cloud Storage – Provisioning Cloud Storage*	*Programming Environment for GAE*

S-4	SLO-1	*Issues in Distributed Systems*	*Cloud Characteristics- Elasticity in Cloud*	*Full and Para Virtualization*	*Cloud Storage – Provisioning Cloud Storage*	*Programming Environment for GAE*
S-5 – S-8	SLO-1	Lab 1: Practical - Implement RPC and Bankers algorithm.	Lab 4: Use Google collaboration tools: Create Google Docs, Sheets and Slides and share it with other users.	Lab 7: Create a simple web service using Python Flask/Java/any language [Web Service: Client-server model should be implemented using socket/http].	Lab 10: Use security tools like ACUNETIX, ETTERCAP to scan web applications on the cloud.	Lab13: Install and configure OpenStack all-in-one using Devstack/Packstack.
S-9	SLO-1	Distributed System Model	On-demand Provisioning	Implementation Levels of Virtualization	Managed and Unmanaged Cloud Storage	Architecture of GFS
S-10	SLO-1	*Request/Reply Protocols*	*NIST Cloud Computing Reference Architecture*	*Tools and Mechanisms*	*Cloud Security Overview*	*Case Studies: Openstack, Heroku and Docker Containers*
S-11	SLO-1	*RMI*	*Architectural Design Challenges*	*Virtualization of CPU*	*Cloud Security Challenges*	*Amazon EC2*
S-12	SLO-1	*RMI*	*Architectural Design Challenges*	*Virtualization of CPU*	*Cloud Security Challenges*	*Amazon EC2*
S-13 – S-16	SLO-1	Lab 2: Create and distribute a Torrent file to share a file in LAN Environment.	Lab 5: Explore public cloud services like Amazon, Google, Sales Force, Digital Ocean etc	Lab 8:Install Oracle Virtual Box/VMware Workstation and create a chat application [Note: Launch two virtual machines for chat application].	Lab 11: Cloud networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.	Lab 14: Launch VMs in OpenStack through dashboard.
S-17	SLO-1	*Logical Clocks and Casual Ordering of Events*	*Deployment Models: Public, Private and Hybrid Clouds*	*Memory – I/O Devices*	*Architecture Design – Virtual Machine Security*	*AWS*
S-18	SLO-1	*RPC- Election Algorithm*	*Service Models: IaaS- PaaS – SaaS*	*Desktop Virtualization*	*Security – Application Security*	*Microsoft Azure*
S-19	SLO-1	Distributed Mutual Exclusion	Benefits of Cloud Computing.	Server Virtualization	Data Security	Google Compute Engine.
S-20	SLO-1	Distributed Deadlock Detection Algorithms	Benefits of Cloud Computing.	Server Virtualization	Data Security	Google Compute Engine.
S-21 – S-24	SLO-1	Lab 3: Demonstration and assessment of the implemented algorithms.	Lab 6: Quizzes on different service models and deployment models. Report submission - Comparison of various services provided by different Cloud Service Providers (configuration of VM, cost, network bandwidth etc.).	Lab 9: Review web services implementation - Proper Connection should be established between the client and server to make use of the service offered by the Server. Review the working of application in virtual environment.	Lab12: Report submission - Generate a detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loopholes.	Lab 15: OpenStack Dashboard should be accessed though web browser. Verify the working of instance by logging into it/pinging the instance.

Learning Resources	*1. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems - Principles and Paradigms", Second Edition, Pearson, 2006.* *2. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", John Wiley& Sons, 2011.*	*1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.* *2. Mukesh Singhal, "Advanced Concepts In Operating Systems", McGraw Hill Series in Computer Science, 1994.* *3.John W.Rittinghouse, James F.Ransome, "Cloud Computing: Implementation "Management, and Security", CRC Press, 2010.*

Learning Assessment

Level	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember Understand	20%	20%	15%	15%	15%	15%	15%	15%	15%	15%
Level 2	Apply Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Evaluate Create	10%	10%	15%	15%	15%	15%	15%	15%	15%	15%
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr.G.Muruganandam, Group Project Manager, HCL Technologies, Chennai	Dr.Muthu, Professor, Loyola College, Chennai	***Dr.J.Dhilipan, SRMIST***
Mr.M. Hemachandar, Tech Lead, Wipro Limited, Chennai	Dr.Vincent, Associate Professor, VIT	