Course Code	PCA20D08J	Course Name	CLOUD COMPUTING	Course Category	D	Discipline Elective Course	L	T	P	C
							3	0	2	4

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 :	To develop an awareness of the need for project planning and management.
CLR-2 :	To know about software effort estimation and activity planning.
CLR-3 :	To explore risk and people management.
CLR-4 :	To learn about project monitoring and control mechanisms.
CLR-5 :	To know about software quality management.
CLR-6 :	To Learn About Process Models.

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	Differentiate between various software process models.	3	80	70
CLO-2 :	Prepare project planning documents.	3	85	75
CLO-3 :	Estimate the software cost for projects.	3	75	70
CLO-4 :	Perform effective activity planning.	3	85	80
CLO-5 :	Prepare effective project scheduling work product.	3	85	75
CLO-6 :	Perform software quality management activities.	3	80	70

Program Learning Outcomes (PLO)	1 Disciplinary Knowledge	2 Critical Thinking	3 Problem Solving	4 Analytical Reasoning	5 Research Skills	6 Team Work	7 Scientific Reasoning	8 Reflective Thinking	9 Self-Directed Learning	10 Multicultural Competence	11 Ethical Reasoning	12 Community Engagement	13 ICT Skills	14 Leadership Skills	15 Life Long Learning
CLO-1 :	L	H	H	H	H	M	-	H	M	H	-	H	-	-	-
CLO-2 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-3 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-4 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-5 :	M	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-6 :	M	H	H	H	H	M	-	M	M	L	-	H	-	-	-

Duration (hour)		15	15	15	15	15
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-S-5	**SLO-1**	***Lab 1: Practical - Implement RPC and Bankers algorithm.***	***Lab 4: Use Google collaboration tools: Create***	***Lab 7: Create a simple web service using Python***	***Lab 10: Use security tools like ACUNETIX, ETTERCAP to***	***Lab13: Install and configure OpenStack all-in-one using Devstack/Packstack.***

			Google Docs, Sheets and Slides and share it with other users.	***Flask/Java/any language [Web Service: Client-server model should be implemented using socket/http].***	***scan web applications on the cloud.***	
S-6	SLO-1	*Distributed System Model*	*On-demand Provisioning*	*Implementation Levels of Virtualization*	*Managed and Unmanaged Cloud Storage*	*Architecture of GFS*
S-7	SLO-1	*Request/Reply Protocols*	*NIST Cloud Computing Reference Architecture*	*Tools and Mechanisms*	*Cloud Security Overview*	*Case Studies: Openstack, Heroku and Docker Containers*
S-8	SLO-1	*RMI*	*Architectural Design Challenges*	*Virtualization of CPU*	*Cloud Security Challenges*	*Amazon EC2*
S-9-10	**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-11	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-12	SLO-1	*RPC- Election Algorithm*	*Service Models: IaaS- PaaS – SaaS*	*Desktop Virtualization*	*Security – Application Security*	*Microsoft Azure*
S-13	SLO-1	*Distributed Mutual Exclusion - Distributed Deadlock Detection Algorithms*	*Benefits of Cloud Computing.*	*Server Virtualization.*	*Data Security*	*Google Compute Engine.*
S-14-15	**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
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