



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTOR

Course Title	CLOUD COMPUTING				
Course Code	AIT007				
Programme	B.Tech				
Semester	VII	IT			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	1	4	3	2
Chief Coordinator	Mr. A. Praveen, Assistant Professor, IT				
Course Faculty	Mr. A. Praveen, Assistant Professor, IT				

I. COURSE OVERVIEW:

Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years. The exponential growth data size in scientific instrumentation/simulation and social media has triggered the wider use of cloud computing services. We will explore solutions and learn design principles for building large network-based systems to support both compute and data intensive computing across geographically distributed infrastructure.

II. COURSE PRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AIT007	III	Database Management Systems
UG	AIT007	IV	Computer Networks
UG	AIT007	IV	Operating Systems

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Cloud Computing	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

✗	Chalk & Talk	✓	Quiz	✓	Assignments	✗	MOOCs
✓	LCD / PPT	✓	Seminars	✗	Mini Project	✓	Videos
✗	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into FIVE modules and each module carries equal weightage in terms of marks distribution. The question paper pattern is as follows. Two full questions with “either” or “choice” will be drawn from each module. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):

CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz or Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	Theory		Total Marks
	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):

Two CIE exams shall be conducted at the end of the 8th and 16th week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of five descriptive type questions out of which four questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz - Online Examination

Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are to be answered by choosing the correct answer from a given set of choices (commonly four). Such a question paper shall be useful in testing of knowledge, skills, application, analysis, evaluation and understanding of the students. Marks shall be awarded considering the average of two quiz examinations for every course.

Alternative Assessment Tool (AAT)

This AAT enables faculty to design own assessment patterns during the CIA. The AAT converts the classroom into an effective learning centre. The AAT may include tutorial hours/classes, seminars, assignments, term paper, open ended experiments, METE (Modeling and Experimental Tools in Engineering), five minutes video, MOOCs etc.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	SEE/CIE/ Term Paper
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Laboratory Practices/ Assignments
PO 3	Design/development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	1	Laboratory Practices / Mini Project
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	3	Laboratory Practices / Mini Project / Seminar

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer - based systems of varying complexity.	1	SEE/CIE/ Laboratory Practices
PSO 2	Software Engineering Practices: The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.	3	Laboratory Practices / Mini Project/ Seminar

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Understand the concepts of cloud computing for developing the cloud applications
II	Understand task scheduling algorithms and virtualization
III	Analyze the security issues in cloud environments
IV	Gain knowledge in the broad perspective of cloud architecture and model
V	Analyze and understand the importance of various applications of cloud computing

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Describe the concept of cloud computing and challenges	CLO 1	Define cloud computing and related concepts
		CLO 2	Understand the key dimensions of the challenges of Cloud Computing
		CLO 3	Understand the cloud services of Amazon, Google, Azure online services.
		CLO 4	Develop the applications developments of Amazon web services
CO 2	Determine the cloud models with applications	CLO 5	Understand the Cloud architecture and programming model
		CLO 6	Describe the compute intensive model and data intensive model
		CLO 7	Determine the map reducing in cloud
		CLO 8	Describe the graph processing
CO 3	An ability to identify and evaluate the requirements of software product	CLO 9	Determine programming models of pregl and other big data
		CLO 10	Understanding the cloud resource virtualization
		CLO 11	Describe the Emulation of CRV

COs	Course Outcome	CLOs	Course Learning Outcome
		CLO 12	Determine the application virtualization, applying virtualization
CO 4	To describe the management and scheduling	CLO 13	Understanding the Cloud Resource Management and Scheduling
		CLO 14	Determine cloud scheduling subject to deadlines
		CLO 15	Describe fairing
		CLO 16	Understand the resource management and application scaling
CO 5	Understand issues and solve by clearing risks with security	CLO 17	Describe the Cloud Security i.e., Risks, Privacy and Privacy impacts assessments
		CLO 18	Understand the Compliance issues
		CLO 19	Determine the how standards deal with cloud services and virtualization
		CLO 20	Describe compliance for the cloud provider vs compliance for the customer.

X. COURSE LEARNING OUTCOMES (CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AIT007.01	CLO 1	Define cloud computing and related concepts	PO 1	3
AIT007.02	CLO 2	Understand the key dimensions of the challenges of Cloud Computing	PO 2	2
AIT007.03	CLO 3	Understand the cloud services of Amazon, Google, Azure online services.	PO 1	3
AIT007.04	CLO 4	Develop the applications developments of Amazon web services	PO 1, PO 3	3
AIT007.05	CLO 5	Understand the Cloud architecture and programming model	PO 2	2
AIT007.06	CLO 6	Describe the compute intensive model and data intensive model	PO 2	2
AIT007.07	CLO 7	Determine the map reducing in cloud	PO 2	2
AIT007.08	CLO 8	Describe the graph processing	PO 2	2
AIT007.09	CLO 9	Determine programming models of pregel and other big data	PO 4	1
AIT007.10	CLO 10	Understanding the cloud resource virtualization	PO 4	1
AIT007.11	CLO 11	Describe the Emulation of CRV	PO 2	2
AIT007.12	CLO 12	Determine the application virtualization, applying virtualization	PO 2	2
AIT007.13	CLO 13	Understanding the Cloud Resource Management and Scheduling	PO 4	2
AIT007.14	CLO 14	Determine cloud scheduling subject to deadlines	PO 2	2
AIT007.15	CLO 15	Describe fairing	PO 3	1
AIT007.16	CLO 16	Understand the resource management and application scaling	PO 2	2
AIT007.17	CLO 17	Describe the Cloud Security i.e., Risks, Privacy and Privacy impacts assessments	PO 3	1

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
AIT007.18	CLO 18	Understand the Compliance issues	PO 2	2
AIT007.19	CLO 19	Determine the how standards deal with cloud services and virtualization	PO 3	1
AIT007.20	CLO 20	Describe compliance for the cloud provider vs compliance for the customer.	PO 2	2

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XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes (POs)				
	PO 1	PO 2	PO 3	PO5	PSO1
CO 1	3	2			2
CO 2		2			
CO 3		2		1	1
CO 4		2	3		
CO 5	2	2	2		2

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XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1	3												2		
CLO 2		2													
CLO 3	3												1		
CLO 4	3												1		
CLO 5		2													
CLO 6		2													
CLO 7		2													
CLO 8		2													
CLO 9					1										
CLO 10					1										

Course Learning Outcomes (CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 11		2											1		
CLO 12		2											1		
CLO 13			3												
CLO 14			3												
CLO 15			3												
CLO 16		2												1	
CLO 17	2	2												2	
CLO 18														1	
CLO 19			2											1	
CLO 20	2	2													

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XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PSO 1	SEE Exams	PO 1, PSO 1	Assignments	PO 2	Seminars	PO 5, PSO 2
Laboratory Practices	PO 2, PO 3, PO 5, PSO 1, PSO 2	Student Viva	-	Mini Project	PO 3, PO 5, PSO 2	Certification	-
Term Paper	PO1						

XIV. ASSESSMENT METHODOLOGIES - INDIRECT

✓	Early Semester Feedback	✓	End Semester OBE Feedback
✗	Assessment of Mini Projects by Experts		

XV. SYLLABUS

Unit-I	SYSTEM MODELING, CLUSTERING AND VIRTUALIZATION
Scalable computing over the Internet, Technologies for network-based systems, System models for distributed and cloud computing, Software environments for distributed systems and clouds Performance, security and energy efficiency	
Unit -II	VIRTUAL MACHINES AND VIRTUALIZATION OF CLUSTERS AND DATA CENTERS
Implementation levels of virtualization, Virtualization tools, structures and mechanisms, Virtualization of CPU, Memory and I/O devices, Virtual clusters and resource management, Virtualization for data center automation.	

Unit -III	CLOUD PLATFORM ARCHITECTURE
Cloud computing and service models, Architectural design of compute and storage clouds, Public cloud platforms, Inter-cloud resource management, Cloud security and trust management, Service oriented architecture (SOA), Message-oriented middleware	
Unit -IV	CLOUD PROGRAMMING AND SOFTWARE ENVIRONMENTS
Features of Cloud and grid platforms, Parallel and distributed programming paradigms, Programming support of Google App Engine, Programming on Amazon AWS and MS Azure, Emerging cloud software environments.	
Unit -V	CLOUD RESOURCE MANAGEMENT AND SCHEDULING
Policies and mechanisms for resource management applications of control theory to task scheduling in a cloud, Stability of a two-level resource allocation architecture, Feedback controls based on dynamic thresholds, Coordination of specialized autonomic performance managers, Resource Bundling	
Textbooks:	
<ol style="list-style-type: none"> 1. Cloud computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M.Goscinski, wiley,2011 2. Distributed and Cloud Computing, Kai Hwang, Geofferyu C.Fox, Jack J.dongarra, Elsevier, 2012 3. Distributed and Cloud Computing, Kai Hwang et al, Elsevier. 4. Cloud Computing, Theory and Practice, Dan Marinescu, Elsevier. 5. Cloud Computing, A Hands-On Approach, Arshadeep Bagra and Vijay Madiseti, University Press. 	
Reference Books:	
<ol style="list-style-type: none"> 1. Cloud Computing: A practical approach, Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, Tata McGrawHill,2011 2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University press,2010 3. Cloud Computing: Implementation, Management and Security, John W. Ritting house, James F. Ransom, CRC press, rp2012 4. Cloud Applications Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O Reilly, SPD, rp2011 5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, im Mather, Subra Kumaraswamy,S hahed Latif, O reilly, SPD, rp2011 	

XVI. COURSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1-2	Define Cloud Computing Describe characteristics, benefits, challenges of cloud computing	CLO 1	T1: 1.1, 1.2
3-4	Describe Cloud models in detail	CLO 2	T1: 1.2
5-6	Identify the types of cloud computing	CLO 3	T1: 1.2
7-8	Explain different types of cloud services.	CLO 3	T1: 1.3
9-10	Illustrate various applications of cloud computing	CLO 4	T1: 3.6
11-12	Describe cloud architecture in detail	CLO 5	T1: 1.1
13-14	Explain NIST reference architecture and various architectural styles of cloud applications	CLO 6	T1: 1.1, T1: 3.8
14-15	Explain the Programming model and Compute intensive model	CLO 7	T1: 4.2,4.3
16-17	Describe in detail the parallel computation – BSP , workflows, coordination of multiple activities – zoo keeper	CLO 7	T1: 4.2,4.3 T2:26.10

18-19	Elaborate about Data intensive model	CLO 8	T1: 4.4
20-21	Define virtualization Illustrate types of virtualization techniques	CLO 9	T1: 4.7
22-23	Explain merits and demerits of virtualization Distinguish between full vs Para-virtualization	CLO 10	T1: 4.9
24-25	Explain in detail about virtual machine monitor/hypervisor	CLO 11	T1: 4.9
26-27	Explain about Interpretation and binary translation	CLO 12	T1: 5.1,5.4
28-29	Describe in detail about cloud resource virtualization	CLO 13	T1: 5
30-31	Describe virtual machines,	CLO 02	T1: 5.1
32-33	Illustrate in detail about storage, desktop and application virtualization	CLO 14	T1: 6.1,6.4,6.5
34-35	Describe in brief about cloud resource management and scheduling	CLO 8	T1: 6.1
36-37	What are the various policies and mechanisms for resource management, resource bundling, combinatorial?	CLO 15	T1: 6.1,
38-39	What is fair queuing, start time fair queuing, borrowed virtual time	CLO 9	T1: 6.9, 6.10, 6.11
40-41	Explain about map reduce applications subject to deadlines,	CLO 16	T1: 6.13
42-43	Describe in detail about resource management and application scaling.	CLO 17	T1: 6.14
44-45	Describe in detail about Network level security	CLO 18	T1: 9
46-47	Explain in detail about host level security	CLO 19	T1: 9.5
48-49	Explain in detail about application level security	CLO 7	T1: 9.6
50-51	What are the various data security issues?	CLO 16	T1: 9.1
52-53	Explain about data privacy, data security issues.	CLO 17	T1: 9.1
54-55	Explain about other security issues	CLO 20	T1: 9.9
56-57	Describe in detail about authentication in cloud computing,	CLO 4	T1: 9.1
58-60	How to process client access in cloud	CLO 7	T1: 9.1

XVII. GAPS IN THE SYLLABUS-TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Service Provider Reliability in Cloud Computing	Assignment	PO 1, PO 3	PSO 1, PSO 2
2	Vendor lock-in Cloud Computing	Assignment	PO 2, PO 3	PSO 1, PSO 2

Prepared by:
Mr. A Praveen , Assistant Professor

HOD, IT