INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTOR

Course Title	**CLOUD APPLICATION DEVELOPMENT**				
Course Code	ACS011				
Programme	B.Tech				
Semester	VII	CSE			
Course Type	Core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	1	4	3	2
Chief Coordinator	Dr. D Kishore Babu, Associate Professor				
Course Faculty	Mr. P Anjaiah, Assistant Professor, CSE Mr. C Praveen Kumar,Assistant Professor, CSE Ms. B Vijaya Durga, Assistant Professor, CSE				

I. COURSE OVERVIEW:

The present course concentrates on cloud computing, 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	Credits
UG	ACS005	IV	Database Management Systems	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Cloud Application Development	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**
Type of Assessment	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). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

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	Presentation on real real-world problems
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	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	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	Seminar
PSO 2	**Problem-Solving Skills**: 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
PSO 3	**Successful Career and Entrepreneurship**: The ability to employ modern computer languages, environments and platforms in creating innovative career paths to be an entrepreneur and a zest for higher studies	3	Seminar

3 = High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES (COs):

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 perceptive 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 date intensive model
		CLO 7	Determine the map reducing in cloud
		CLO 8	Describe the graph processing with an example
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
		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
ACS011.01	CLO 1	Understand the cloud computing and related concepts	PO 1	3
ACS011.02	CLO 2	Understand the key dimensions of the challenges of Cloud Computing	PO 2	2
ACS011.03	CLO 3	Understand the cloud services of Amazon, Google, Azure online services.	PO 1	3
ACS011.04	CLO 4	Develop the applications developments of Amazon web services	PO 1, PO 3	3
ACS011.05	CLO 5	Understand the Cloud architecture and programming model	PO 2	2
ACS011.06	CLO 6	Describe the compute intensive model and date intensive model	PO 2	2

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACS011.07	CLO 7	Determine the map reducing in cloud	PO 2	2
ACS011.08	CLO 8	Describe the graph processing with an example	PO 2	2
ACS011.09	CLO 9	Determine programming models of pregl and other big data	PO 4	1
ACS011.10	CLO 10	Understanding the cloud resource virtualization	PO 4	1
ACS011.11	CLO 11	Describe the Emulation of CRV	PO 2	2
ACS011.12	CLO 12	Determine the application virtualization, applying virtualization	PO 2	2
ACS011.13	CLO 13	Understanding the Cloud Resource Management and Scheduling	PO 4	2
ACS011.14	CLO 14	Determine cloud scheduling subject to deadlines	PO 2	2
ACS011.15	CLO 15	Describe fairing	PO 3	1
ACS011.16	CLO 16	Understand the resource management and application scaling	PO 2	2
ACS011.17	CLO 17	Describe the Cloud Security i.e., Risks, Privacy and Privacy impacts assessments	PO 3	1
ACS011.18	CLO 18	Understand the Compliance issues	PO 2	2
ACS011.19	CLO 19	Determine the how standards deal with cloud services and virtualization	PO 3	1
ACS011.20	CLO 20	Describe compliance for the Cloud provider vs compliance for the customer.	PO 2	2

3= High; 2 = Medium; 1 = Low

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										
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													

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENT METHODOLOGIES – DIRECT

CIE Exams	PO 1, PSO 1	SEE Exams	PO 1, PSO 1	Assignments	PO 2	Seminars	PO 5, PSO 1, PSO 3
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	**INTRODUCTION AND CLOUD APPLICATION DEVELOPMENT**
Introduction: Definition, Characteristics, Benefits, challenges of cloud computing, cloud models: serviceIaaS(infrastructure as service),PaaS(platform as a service),SaaS(software as a service), deployment models-public, private, hybrid, community; Types of cloud computing: Grid computing utility computing, cluster; computing Cloud services: Amazon, Google, Azure, online services, open source private clouds, SLA; Applications of cloud computing: Healthcare, energy systems, transportation, manufacturing, education, government, mobile communication, application development;	
Unit -II	**CLOUD ARCHITECTURE, PROGRAMMING MODEL**
Cloud Architecture, programming model: NIST reference architecture, architectural styles of cloud applications, single, multi, hybrid cloud site, redundant, non redundant, 3 tier, multi tier architectures; Programming model: Compute and data intensive; Compute intensive model: Parallel computation, BSP, workflows, coordination of multiple activities - zoo keeper; Data intensive model	
Unit -III	**CLOUD RESOURCE VIRTUALIZATION**
Cloud resource virtualization: Basics of virtualization, types of virtualization techniques, merits and demerits of virtualization, Full vs Para - virtualization, virtual machine monitor/hypervisor - virtual machine basics, taxonomy of virtual machines, process vs system virtual machines.Emulation: Interpretation and binary translation, HLL, virtual machines, storage, desktop and application virtualization, applying virtualization.	
Unit -IV	**CLOUD RESOURCE MANAGEMENT AND SCHEDULING**
Cloud Resource Management and Scheduling: Policies and mechanisms for resource management, resource bundling, combinatorial , fair queuing, start time fair queuing, borrowed virtual time, cloud scheduling subject to deadlines, scheduling map reduce applications subject to deadlines, resource management and application scaling.	
Unit -V	**CLOUD SECURITY**
Cloud Security: Risks, privacy and privacy impacts assessments; Multi-tenancy issues, security in VM, OS, virtualization system security issues and vulnerabilities; Virtualization system-specific attacks: Technologies for virtualization-based security enhancement, legal; Compliance issues: Responsibility, ownership of data, right to penetration test, local law where data is held, examination of modern security standards (eg: PCIDSS), how standards deal with cloud services and virtualization, compliance for the cloud provider vs compliance for the customer	
Text Books:	
1. Dan Marinescu, ― Cloud Computing: Theory and Practice‖, M K Publishers, 1st Edition, 2013. 2. Kai Hwang, Jack Dongarra, Geoffrey Fox, ― Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, M K Publishers, 1st Edition, 2011	
Reference Books:	
1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, - Cloud Computing: A Practical Approach‖, McGraw Hill, 1st Edition, 2009. 2. Arshdeep Bahga, ―Cloud Computing: A Hands on Approach‖, Vijay Madisetti Universities Publications, 1st Edition, 2013.	

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 details 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	R2: 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	R1: 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	R2: 9.6
50-51	What are the various data security issues	CLO 16	T1: 9.1

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 details 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	R2: 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
52-53	Explain about data privacy, data security issues.	CLO 17	T1: 9.1
54-55	Explain about other security issues	CLO 20	R1: 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	NPTEL	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:

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