

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTHAPURAMU

COLLEGE OF ENGINEERING (AUTONOMOUS): PULIVENDULA

Regulation –R15

Course Code	:	15ACS36			
Course Title	:	CLOUD COMPUTING			
Course Structure	:	Lectures	Tutorials	Practical's	Credits
		3	1	0	4
Course Coordinator	:	Sri K.Balachandra Reddy Asst-professor(Adhoc)			

I. Course Overview

Cloud Computing has emerged in recent years as a new paradigm for hosting and delivering services over the Internet. This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The course will introduce this domain and cover the topics of data centers, virtualization, cloud storage, and programming models. The students will have an opportunity to explore the Cloud Computing various terminology, principles and applications. This course also provides vast exposure to the students in different views of understanding the Cloud Computing in terms of theoretical, technical and commercial aspects.

II. Prerequisite(s):

Level	Credits	Periods/Week	Prerequisites
UG	4	4	Basic Concepts of Distributed Systems

III. Assessment:

FORMATIVE ASSESSMENT	
Mid Semester Subjective Test I for 20 Marks in first 2 units is conducted at the end of 9th week. (Subjective paper shall contain 5 questions of which, student has to answer 3 questions)	20 Marks

Mid Semester Objective Test I for 10 Marks in first 2 units is conducted at the end of 9th week (Objective paper is set for 20 bits)	10 Marks
Total	30 Marks
Mid Semester Subjective Test II for 20 Marks in first 2 units is conducted at the end of the course (Subjective paper shall contain 5 questions of which, student has to answer 3 questions)	20 Marks
Mid Semester Objective Test II for 10 Marks in first 2 units is conducted at the end of the course (Objective paper is set for 20 bits)	10 Marks
Total	30 Marks
Final Internal marks for a total of 30marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weight-age to the better mid exam and 20% to the other.	

SUMMATIVE ASSESSMENT	
End Semester Examination in all units is conducted for 70 Marks	70 Marks
Grand Total	100 Marks

IV. Course Objectives

1. To understand fundamental Concepts of Virtualization that includes Application, Server, Desktop and Storage Virtualization
2. To impart fundamental ideas behind Cloud Computing, the evolution of the paradigm, its applicability, benefits, as well as current and future challenges
3. To provide students a sound foundation of the Cloud Application Architecture
4. To gain knowledge on various security issues in cloud architecture.

V. Course Outcomes

1. Acquires knowledge on the fundamental concepts of virtualization and its importance in various cloud deployment models
2. Demonstrate different virtualization technologies

3. Obtain knowledge on cloud components, infrastructure and services
4. Analyze various cloud application architectures.
5. Apply various security measures on cloud architecture in solving real time security issues

VI. Program Outcomes:

- a. An ability to apply knowledge of computing, mathematical foundations, algorithmic principles, and computer science and engineering theory in the modeling and design of computer-based systems to real-world problems (fundamental engineering analysis skills)
- b. An ability to design and conduct experiments, as well as to analyze and interpret data (information retrieval skills)
- c. An ability to design , implement, and evaluate a computer-based system, process, component, or program to meet desired needs, within realistic constraints such as economic, health and safety, manufacturability, and sustainability (Creative Skills)
- d. An ability to function effectively on multi-disciplinary teams (team work)
- e. An ability to analyze a problem, identify, formulate and use the appropriate computing and engineering skills for obtaining its solution (engineering problem solving skills)
- f. Obtaining the knowledge of algorithmic skills regarding data structures. (program oriented skills)
- g. An ability to communicate effectively both in writing and orally (speaking / writing skills)
- h. The broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society (engineering impact assessment skills)
- i. Recognition of the need for, and an ability to engage in continuing professional development and life-long learning (continuing education awareness)
- j. A Knowledge of structural skills which are related to theoretical skills for programming (detailed subject oriented skills).
- k. An ability to use current techniques, skills, and tools necessary for computing and engineering practice (practical engineering analysis skills)
- l. An ability to apply design and development principles in the construction of software and

hardware systems of varying complexity (software hardware interface)

- m. An ability to recognize the importance of professional development by pursuing postgraduate studies or face competitive examinations that offer challenging and rewarding careers in computing (successful career and immediate employment)

VII B.Tech IV-ISem(R15)

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CLOUD COMPUTING

Course Objectives:

1. To provide detailed and ample knowledge of the Cloud Computing fundamental issues, technologies, applications and implementations.
2. To expose the students to the cutting edge areas of Cloud Computing
3. To provide practical in-sight to the students in developing cloud applications
4. To shed light on the Security issues in Cloud Computing.

Course Outcomes: After successful completion of the course student will be able to:

1. Communicate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Categorise the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Elucidate the core issues of cloud computing such as security, privacy, and interoperability.
4. Provide the appropriate cloud computing solutions and recommendations according to the applications used.

UNIT I – Fundamentals of Distributed Computing and Cloud Evolution

History of Centralized and Distributed Computing - Overview of Distributed Computing, Cluster computing, Grid computing. Technologies for Network based systems- System models for Distributed and cloud computing- Software environments for distributed systems and clouds.

UNIT II – Introduction to Cloud Computing and Virtualization

Introduction to Cloud Computing- Cloud issues and challenges - Properties - Characteristics - Service models, Deployment models. Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage. Virtualization concepts - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, load balancing and migration of VMs .

UNIT III – Cloud Application Programming

Cloud Programming and Software Environments- Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine- Aneka platform- Anatomy of Aneka Container- Building Aneka Clouds- Aneka SDK.

UNIT IV - Concurrent Computing and Data-Intensive Computing

Concurrent Computing: Introducing parallelism for single-machine computation, Programming applications with threads, Multithreading with aneka, Programming applications with aneka threads.

Data-Intensive Computing: What is data-intensive computing? Technologies for data-intensive computing, Aneka Map-Reduce programming.

UNIT V- Cloud Security

Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, “Distributed and cloud computing from Parallel Processing to the Internet of Things”, Morgan Kaufmann, Elsevier – 2012
2. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, “Mastering Cloud Computing: Foundations and Applications Programming” Morgan Kaufmann, Elsevier.
3. “Cloud Computing: A Hands-On Approach” by ArshdeepBahga And Vijay Madisetti

REFERENCES:

1. Barrie Sosinsky, “ Cloud Computing Bible” John Wiley & Sons, 2010
2. Tim Mather, SubraKumaraswamy, and ShahedLatif, Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009

VII. Course Plan:

Lecture No	Course Outcomes	Topics to be Covered	Reference
UNIT-I			
3/7/19	Acquire Knowledge of Centralized and Distributed Computing,	History of Centralized and Distributed Computing,	T1: Chapter 1, 1.1 - 1.3
4/7/19	Acquire Knowledge of Distributed Computing	Overview of Distributed Computing	T1: Chapter 1, 1.3
5/7/19	analyze the Key concepts of cluster and grid computing	Cluster computing, Grid computing.	T1: Chapter 1, 1.3 - 1.5
10/7/19	Gain Technologies for Network based systems	Technologies for Network based systems- System models for Distributed	T1: Chapter 1, 1.6 - 1.7
11/7/19	Gain Technologies for Network based systems	Technologies for Network based systems- System models for cloud computing	T1: Chapter 1, 1.7
12/7/19	Demonstrate Software environments for distributed systems and clouds	Software environments for distributed systems and clouds	T1: Chapter 1, 1.8
17/7/19	Demonstrate Software environments for clouds	Software environments for clouds	T1: Chapter 1, 1.8
UNIT –II			
18/7/19	Identify the issues and challenges in cloud computing	Introduction to Cloud Computing- Cloud issues and challenges - Properties	T1: Chapter 3, 3.1-3.4
19/7/19	Identify the issues and challenges in cloud computing	Cloud issues and challenges - Properties	T1: Chapter 3, 3.4

24/7/19	Obtain Knowledge about the services and deployment models	Characteristics - Service models, Deployment models.	T1: Chapter 3, 3.5-3.8
25/7/19	Gain familiarity with different types of resources	Cloud resources: Network and API - Virtual and Physical computational resources - Data-storage.	T1: Chapter 3, 3.9-3.12
26/7/19	Demonstrate the concept of Application, storage and Processor Virtualization	Virtualization concepts - Types of Virtualization-	T1: Chapter 3, 3.13-3.15
31/7/19	Types of Virtualization	Types of Virtualization	T1: Chapter 3,3.15
1/8/19& 2/8/19	Acquire Knowledge on Hypervisors virtualization	Introduction to Various Hypervisors High Availability (HA)/Disaster Recovery (DR) using Virtualization	T1: Chapter 3, 3.16-3.18
7/8/19	Ability to implement Virtualization	load balancing and migration of VMs .	T1: Chapter 3, 3.19
8/8/19& 9/8/19	Gain Knowledge on storage virtualization	virtualization software, data storage virtualization	T1: Chapter 3, 3.19-3.20
UNIT-III			
14/8/19& 16/8/19	Obtain familiarity with cloud software environments	Cloud Programming and Software Environments- Parallel and Distributed	Ref.T1 :Chapter 1,

		Programming paradigms.	
28/8/19	An Understanding of importance of Microsoft Azure	Programming on Amazon AWS and Microsoft Azure	http://www.tutorialspoint.com
29/8/19	Gain the knowledge on working with Google App Engine	. Programming support of Google App Engine- Aneka platform	http://www.ics.uci.edu/~cs237/lectures/App_Engine_PPT.ppt
30/8/19	Gain Knowledge on building Aneka clouds	Anatomy of Aneka Container- Building Aneka Clouds- Aneka SDK.	T2: Chapter 4 Pg.no 17
4/9/19	An Understanding of cloud computing software	Cloud Computing Technology- Hardware & Software	Ref.T1 :Chapter 5
UNIT-IV			
5/9/19&6/9/19	Gain Knowledge on Basic cloud computing parallelism	Concurrent Computing: Introducing parallelism for single-machine computation	Ref.T5 :Chapter 4, 4.1
11/9/19	Analyze Cloud reference model	Cloud Reference Model	Ref.T5 :Chapter 4, 4.2-4.3
12/9/19&13/9/19	Gain familiarity on applications multithreading with aneka and programming applications with aneka threads.	Programming applications with threads, Multithreading with aneka, programming applications with Aneka threads.	T2: Chapter 2, Pg. no 7
18/9/19	An understanding data	Data-Intensive	T2: Chapter 2, Pg. no 8

	intensive Computing	Computing: What is data-intensive computing?	
19/9/19& 20/9/19	Analyze the technologies for data intensive computing Ubiquitous and aneka mapreduce programming	Technologies for data-intensive computing Aneka MapReduce programming.	Ref.T5: chapter 15.4
25/9/19	Ability to differentiate different Distributed computing paradigms	Distributed Computing.	Ref.T1: chapter 1
UNIT-V			
26/9/19	Analyze security issues in cloud computing	Cloud Security	T2: Chapter 5, Pg.no 99
27/9/19	Gain Knowledge on cloud access	Cloud Access: authentication, authorization and accounting	T2: Chapter 5, Pg.no 106-113
3/10/19&4/ 10/19	Analyze reliability and fault-tolerance	Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance	T2: Chapter 6, Pg.no 119-122
9/10/19&1 1/10/19	Acquire knowledge on privacy and policy	Cloud Security, privacy, policy and compliance	T2: Chapter 7, Pg.no 132-145
16/10/19& 23/10/19	Gain familiarity on cloud federation and interoperability	Cloud federation, interoperability and standards.	T2: chapter 7, pg.no 146-152

VIII. Mapping Course Outcomes leading to the achievement of Program Outcomes:

Course	Program Outcomes(PO's)												
Outcomes (CO's)	a	b	c	d	e	F	g	h	i	J	k	l	m
1	H				S						S		
2		S	H		S						S		S
3		S								H			S
4		H										S	
5	S	H											S

S = Supportive H = Highly Related

Justification of Course Syllabus Covering Course Outcomes:

- By covering the syllabus, Student could be able to acquire knowledge on the different types of virtualization in terms of theoretical and practical implementations. Additionally, it provides vast exposure to the students in terms of Cloud Computing environment, Architecture and Cloud applications

Justification of Course Outcomes and Program Outcomes Mapping Table:

- CO-1 is highly related to PO - a and acts as a supportive for PO's - e and k such that, Student can be able to gain knowledge on the fundamentals of virtualization and basic cloud deployment models that could be applied in real time problem solving.
- CO-2 is highly related to PO - c and acts as a supportive for PO's - b, e, k and m such that, Student could acquire knowledge on various virtualization technologies, which helps them in implementation of virtualization concepts and supports them in their career prospectus
- CO-3 is highly related to PO - j and acts as a supportive for PO's - b and m such that, Student will attain exposure on fundamental cloud infrastructure and services that help them in modeling distributed applications

- CO-4 is highly related to PO - b and acts as a supportive for PO - 1 such that, Student will be aware of various Distributed system architectures that support's them in deploying cloud applications and solving real time issues.
- CO-5 is highly related to PO - b and acts as a supportive for PO's - a and m such that, Student will acquire knowledge on various security issues in cloud architecture and measures to be followed during disaster recovery that helps them to design security algorithms for existing cloud architectures.