COURSE NAME: **Cloud Computing**

(A Program Elective for CSE students)   **L-T-P-C: 2-1-0-3**

1. OUTLINE:

This course introduces the concept of cloud computing and associated technologies to students. The theory part of the course introduces students to the concepts of grid, fog, edge and cloud computing, and discusses various enabling technologies of cloud computing such as Service Oriented Architecture and Virtualization. The projects and assignments as part of the course is meant to introduce students to cloud computing platforms such as Amazon Web Services, Microsoft Azure and Google Cloud Platform. The students will also be introduced to the concepts of MapReduce and Hadoop.

2. OBJECTIVES:

This course is meant to provide students with the knowledge of cloud computing and its underlying technologies. This course will provide students with the necessary skills to use cloud computing technologies for developing applications.

3. PRE-REQUISITES:

Basics of Operating Systems and Computer Networks.

4. COURSE OUTLINE (TOPICS):

The following list of topics is tentative.

1. **Introduction to Cloud Computing and its Enabling Technologies**   **[6 Hours]**
   Evolution of Computing - Grid and Utility Computing, Distributed Computing, The vision of Cloud Computing, Characteristics and Benefits; Enabling Technologies of Cloud Computing - Virtualization, Web 2.0, Service Oriented Architecture

2. **Cloud Computing Architecture**   **[4 Hours]**
   Introduction, Cloud Service Models, Cloud Deployment Models, Open Challenges

3. **Virtualization**   **[8 Hours]**
   Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples, Containers and Applications

4. **Cloud Platforms**   **[6 Hours]**

Amazon Web Services, Google Cloud Platform, Microsoft Azure, Aneka, OpenStack, Cloud Automation using CHEF/Ansible

5. **Introduction to Bigdata** [6 Hours]
   Bigdata Concepts, Terminology, NoSQL; Distributed File Systems - Hadoop File System, GFS, Introduction to MapReduce and Applications

6. **Cloud Security** [6 Hours]
   Security Issues in Cloud Computing, Hypervisor and VM Security, Data Security in Cloud Environment, Identity and Access Management in Cloud

5. TENTATIVE WEEKLY PLAN

Module	Week	Topics Scheduled to be Covered
1	1	Evolution of Computing, Grid and Utility Computing, The vision of Cloud Computing, Characteristics and Benefits
	2	Enabling Technologies - Distributed Computing, Virtualization, Web 2.0, Service Oriented Architecture
2	3	Introduction, Cloud Service Models, Cloud Deployment Models
	4	Open Challenges, Introduction, Characteristics of virtualized environments
3	5	Virtualization techniques, Virtualization and cloud computing
	6	Pros and cons of virtualization, Technology examples, Containers and Applications
4	7	Amazon Web Services, Google Cloud Platform, Microsoft Azure
	8	Aneka, Openstack, Cloud Automation using CHEF/Ansible
5	9	Bigdata Concepts, Terminology, NoSQL; Distributed File Systems - Hadoop File System
	10	GFS, Introduction to MapReduce and Applications
6	11	Security Issues in Cloud Computing, Hypervisor and VM Security
	12	Cloud Data Security, Identity and Access Management in Cloud

6. BOOKS:

Text Books:
1. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing – A Practical Approach, Tata McGraw Hill, First Edition, 2009, ISBN: 9780070683518.
2. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, First Edition, 2009, ISBN: 978-0596156367.

In addition to the prescribed textbooks, suitable research papers will also be used for instruction.

Reference Books:
3. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, Mastering Cloud Computing, Tata Mcgraw Hill, First Edition, 2013, ISBN: 9781259029950
4. Kai Hwang, Geoffrey C. Fox and Jack G. Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann, First Edition, 2012, ISBN: 978-0123858801
5. Rittinghouse, John W. and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, First Edition, 2009, ISBN: 978-1439806807

7. EVALUATION:

Course grades will be based on the following tentative weightage pattern.

a) Examinations: 50%
   Mid Semester Exam: 20%
   End Semester Exam: 30%

b) Research Work / Assignments: 25%

This evaluation component will consist of practical assignments students will implement on cloud computing platforms. Additionally, students will also be asked to read/implement latest research papers in the area.

c) Class Participation (Surprise Quizzes): 10%

This evaluation component will consist of surprise tests conducted during class hours.

d) Scheduled Quizzes: 15%

This evaluation component will consist of announced quizzes which will test the students' comprehension of the topics covered in class

8. COURSE OUTCOMES

At the end of the course, students should have the ability:

CO1: To understand different cloud computing models and underlying technologies.

CO2: To develop real world applications using cloud computing platforms and containerization technologies.

CO3: To implement solutions to complex problems using distributed computing technologies.

CO4: To identify and analyze security issues in cloud computing

9. MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	4	1	5	1	1	1	1	1
CO2	3	4	4	2	2	3	1	3
CO3	3	3	4	3	2	2	1	2
CO4	3	1	3	1	1	1	1	1

10. ETHICS:

Please note down the following activities leading to a fair academic honesty:

a) All class work is to be done independently.

b) It is best to try to solve problems on your own, since problem solving is an important component of the course, and exam problems are often based on the outcome of the assignment problems.

c) You are allowed to discuss class material, assignment problems, and general solution strategies with your classmates. But, when it comes to formulating or writing solutions you must work alone.

d) You may use free and publicly available sources, such as books, journal and conference publications, and web pages, as research material for your answers. (You will not lose marks for using external sources.)

e) You may not use any paid service and you must clearly and explicitly cite all outside sources and materials that you made use of.

f) The use of uncited external sources as portraying someone else's work as your own is a violation of the University's policies on academic dishonesty.

g) Such Instances will be dealt with harshly and typically result in a failing course grade.

11. RESOURCES:

a) Cloud Computing (CS4037D, Monsoon 2020)
   National Institute of Technology Calicut

b) Cloud Computing Technology (CS 349D, Autumn 2018)

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Link: