Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022 - 2023

Course Handout Part II

Date: 30.08.2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CS G527
Course Title : Cloud Computing
Instructor-in-Charge : Dr. Subhrakanta Panda

Course Description : Review of Distributed computing - Concurrency, message passing, connectivity and failure models, replication. Computing Infrastructure Processing Power, Storage aggregation, I/O & Communication, Clusters and Data Centers. Resource modeling and virtualization - CPU virtualization, memory and storage virtualization, virtualized networks. Services - Service models and service contracts; Programming on the cloud. Cloud Applications - Software on the Cloud and Infrastructure Services. Cloud infrastructure - Private vs. Public Clouds, Resource scaling and Resource provisioning. Quality of Service - Performance models, scalability, Performance measurement and enhancement techniques. Security issues - Data/ Storage Security, Resource Access Control, Process Isolation and Control, Service Policies and Privacy Issues.

Scope and Objective of the Course:

Cloud computing is a key distributed systems paradigm that has grown popular in the last few years. Cloud technologies are pervasive and act as the de-facto infrastructure for HPC applications.This course aims to teach the students both the fundamental concepts of how and why cloud systems work, as well as the cloud technologies that manifest these concepts like virtualization. Various cloud service models and cloud deployment models will be discussed. Case studies on open source and commerical cloud environments line Openstack, Google App Engine, Microsoft Azure, and AWS will help the students get the necessary hands-on exposure.

Course Outcome:

The expected outcomes of this course are as follows:

- Students will develop a good understanding of the different architectural as well as the design perspectives of cloud deployment and service models.
- Students will gain hands-on exposure to AWS, Google App Engine, etc., and other open source platforms like Cloudsim.
- Develop understanding of different cloud virtualizations and have hands on implementation.
- To be able to understand and analyze SLAs in cloud systems and its QoS models.
- To be able to analyze and design admission control algorithms.
- To be able to analyze and design scheduling algorithms.
- Analyze the threat models and security challenges in cloud.
- Solve problems through Map-Reduce applications.

Textbooks:

1. Dinkar Sitaram and Geetha Manjunath, “Moving to the Cloud”, Syngress (Elsevier) Pub, 2011.

Reference books

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010.

2. Ronald L. Krutz, Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”, Wiley-India, 2010.
3. Dan C. Marinescu, “Cloud Computing: Theory and Practice”, Elsevier, 2013.

Course Plan:

LNo.	Learning objectives	Topics to be covered	Chapter No.
1-2	To understand grid computing model	Overview of various computational paradigms like cluster computing, grid computing etc; Distributed computing: concurrency, message passing, connectivity and failure models;	Lecture Notes R3 Ch 3.
3-4	To get introduced to cloud computing and analyze the benefits and challenges.	Motivation for Cloud Computing; Introduction to Cloud Computing environment (NIST model), History of Cloud Computing, Cloud Computing architecture: service model, Cloud Computing architecture: deployment model, benefits, challenges, and risks;	T1 Ch 1. NIST Doc. 800-146. R1 Ch 1, Ch 3.
5-6	To understand the Cloud computing architecture:Deployment models	Public, Private, Community, Hybrid, Federated Clouds, Cloud Service Models.	T1 Ch 1. R1 Ch 4.
7-11	To understand and analyze the role of Cloud virtualization	Introduction to cloud virtualization, types of Virtualization, practical aspects of Virtualization; Virtual Machine monitors/hypervisors; VM Life Cycle management;Virtualization of CPU, Storage, I/O, and Network;	T1 Ch 9. R1 Ch 5. R3 Ch 5.
12	To get introduced to Cloud computing architecture: IaaS	Introduction to IaaS; Software stack; Delivery model, Scope of control; Management; IaaS benefits and issues;	T1 Ch 2.
13-20	To understand AWS and get hands-on experience	Reference Model of AWS, Region Vs Availability zones, AWS infrastructure service: Amazon EC2,Amazon S3, Amazon EBS, AWS Import/Export, Amazon RDS, Amazon Cloud Services - CloudFront, Elastic Load Balancer, Elastic Block Storage; Openstack	T1 Ch 2. R1 Ch 9. R3 Ch 11.
21-22	To be able to create cloud containers using dockers.	Cloud orchestration technologies, Dockers - Elements, Images, Files, Containers	Internet Resources
23-26	To get introduced to Cloud computing architecture: PaaSand get hands-on experience GAE/Azure	Introduction to PaaS; Software stack; Dependency; Delivery model; Scope of control; Traditional packaged Platform Vs PaaS;GAE, Microsoft Azure.	T1 Ch 3. R1 Ch 7, Ch 8, Ch 10
27	To get introduced to Cloud computing architecture: SaaS	Introduction to SaaS; Dependancy; Portability; Pros and Cons of SaaS model; Applications of SaaS; Traditional packaged Software Vs SaaS;	T1 Ch 4.
28-30	To understanding the role of Service Level Agreements (SLAs)	Service Level Agreements: Lifecycle and Management; Automated Policy-Based Management; Admission control mechanisms	T1 Ch 8.
31-35	To identify Cloud security issues and threat models	Infrastructure Security: Network level security, Host level security, Application level security; Data security and Storage: Data privacy and security Issues; Identity and Access Management; Access Control; Authentication in cloud computing	T1 Ch 7. R1 Ch 12. R2. R3 Ch 9.
36-37	To get introduced to Rest API	What are APIs? Classification of API, API Protocols, Rest API: structure, elements, Demos	Lecture Notes, Internet Resources.

38-42	To be able to solve problems using MapReduce	Introduction to Distributed File Systems, Case Study HDFS: Hadoop components and understanding MapReduce.	T1 Ch 5, Ch 6. R1 15. R3 Ch 8.

Evaluation Scheme:

Sl. No.	Component	Duration	Weightage (%)	Date & Time	Nature of Component
1	Mid-Semester	90 min	30	05.11.2022, 3.30 – 5.00 PM	Closed Book
2	Term Paper Presentation(TPP)		10	TBA	Open Book
3	LAB Assignments (LA) *(2 Assignments before Mid-semester)*	Evenly Paced	30	TBA	Open Book
4	Comprehensive	3hrs	30	31.12.2022 FN	Closed Book

Note: 40% evaluation to be completed for mid-semester grading.

Chamber Consultation Hour: To be announced in the class.
Notices: Notices regarding the course will be put up on the CSIS notice board and/or CMS.
Make-up Policy: No makeup for TPP and LA components. For any other genuine reasons prior approval from the IC is mandatory. ***No make-up will be given by just producing some medical prescription*** (please refer to the guidelines by AUGSD/AGSRD in this regard)**.**
Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTOR-IN-CHARGE
CSG527