

*Suggested Teaching Guidelines for*

**Cloud Services & Security – PG-DHPCSA September 2023**

**Duration:** 44 class room hours + 56 Lab hours

**Objective:** To reinforce knowledge of Cloud Computing and Operations

**Prerequisites:** Knowledge of Operating systems and computer Networks.

**Evaluation method:** CCEE Theory exam – 40% weightage  
Lab exam (Case Study based) – 40% weightage  
Assignments – 20% weightage

**List of Books / Other training material**

**Text Book:**

1. Cloud Computing Black Book by Kailash Jayaswal, Dreamtech

**Reference:**

2. Mastering Cloud Computing by Rajkumar/ McGraw Hill Education
3. Cloud Computing a practical Approach by AnthonyT Velte/ McGraw Hill Education
4. Cloud Security and Privacy by Tim Mather O'Reilly

**Note: Each session having 2 Hours**

**Session 1:**

- Introduction to Cloud
- Advantages of Cloud
- Cloud types and models
- Cloud service providers

**Assignment:**

- Write definition of cloud by different vendor.
- Write short note on cloud type
- Create a note on cloud service providers in brief in terms of services

**Session 2:**

- Deep dive in to SAAS, PAAS, IAAS
- Application Architecture for Cloud
- Deploying an application in Cloud

**Assignment:**

- SAAS, PAAS, IAAS in brief with example, advantages, disadvantages
- Stack view of cloud service model
- What are the different types of deployment model? also Write sort notes on cloud deployment model

**Session 3 & 4:**

- Creating Amazon EC2 instance

**Assignments:**

- Create AWS EC2 instance
- Create AWS Lambda
- Create AWS S3 bucket
- Create AWS VPC

*Suggested Teaching Guidelines for*

**Cloud Services & Security – PG-DHPCSA September 2023**

- Create a new VPC by the name ditiss-lab with public & private subnet. Assign network address as 172.20.0.0/16. Assign 172.20.5.0/24 to the public and 172.20.10.0/24 to the private subnet. Create one instance and connect to a private subnet. Create one instance and connect to the public subnet. Install httpd on the private instance and check with curl from the public connected instance.

**Session 5 & 6:**

- Introduction to Virtualization
- Types of Hypervisors

**Assignment:**

- What is virtualization?
- Why we need virtualization?
- Benefits of virtualization?
- What are the different types of hardware virtualization list it and write notes on it?
- Install, configure and setup cloud using OpenStack

**Session 7 & 8:**

- Types of Multi tenancy in Cloud computing
- Multi-tenant models for cloud services
- Multi-tenant Data Architecture

**Assignment:**

- What is the Relationship of Clouds and Multi tenancy?
- What are the degrees of multi tenancy?
- How to choose your multi tenants' degree?

**Session 9:**

- Need of Virtualization Provisioning
- Work flow of Virtualization Provisioning
- Challenges in Virtualization
- VM-Specific Security techniques

**Assignment:**

- What is virtualization provisioning
- What are the file types that makes virtual machine?
- What are the devices that can be added on running virtual machine?
- Advantages of thick provisioning of storage over thin provisioning with virtual machine
- How storage and VM sprawl and security impact the virtual data centre.

**Session 10 & 11**

- Understanding OpenStack and its components

**Assignment:**

- Configure an OpenStack cloud, create image, upload to glance and create a virtual machine using that image.

*Suggested Teaching Guidelines for*  
**Cloud Services & Security – PG-DHPCSA September 2023**

**Session 12 &13:**

- Overview of process automation (DevOps)
- Version control with Git
- Branching and Merging in Git, workflows

## Assignment:

- GIT Installation, Version Control, Working with remote repository
- Branching and merging, Stashing, rebasing, reverting and resetting

**Session 14, 15 & 16:**

- Introduction to Jenkins and Maven
- Introduction to Container, LXC, LXK (chroot, cgroups, namespaces)
- Container Standards and Runtimes
- Operations on containers
- Building Container Images
- Container Networking & Storage overview
- Container Security
- Container Life Cycle

## Assignment:

- Build and automation of Test using Jenkins and Maven
- Building Containers

**Session 17&18:**

- Introducing Docker, What it does and why to use it?
- Docker images, Docker CLI
- Dockerfile, Layers in Docker container
- Docker container Networking and Storage overview
- Docker Compose
- Running Hello World in Docker

## Assignment:

- Create and Implement docker images and containers
- Do a local mounting in container
- Create a C program to take input from the user and test it. Then create an image using Dockerfile. Test image by the running container. Then push the image to the docker hub repository. Then also export the image in a “cprog-back.tar” file.

**Session 19 & 20:**

- From Monolith to Microservices
- Introduction to Microservices, platforms and its management
- Container Orchestration
- Architecture and fundamentals of the Kubernetes
- Using Kubectl
- Transform Docker compose using kompose and run multiple containers.
- Minikube cluster

*Suggested Teaching Guidelines for*

**Cloud Services & Security – PG-DHPCSA September 2023**

- Automating application deployment, scaling and management using Kubernetes

Assignment:

- Installing Kubernetes, setting up cluster and deploying application
- Use kompose to convert docker-compose.yml file to Kubernetes file

**Session 21 & 22:**

- Need of encapsulated environments in HPC systems
- Introduction to Singularity
- Installing Singularity in linux
- Singularity configuration file
- Creating containers, images, recipes and understanding singularity flow
- Security aspects and container checks
- Importing docker image into singularity image
- Troubleshooting

Assignment:

- Installing and configuring Singularity on a linux machine
- Creating container, images and recipes
- Importing docker images