

## Lesson Plan

**Branch: Computer Engineering**  
**Semester: VI**

**Year: 2022-23**

<b>Course Title: Cloud Computing (CSL605)</b>	SEE: 3 Hours – Lab
Total Contact Hours: 8 Hours/Week	Duration of SEE: 3 Hrs
SEE Marks: 80 (Theory) + 20 (IA)	
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Checked By:	Date:

**Prerequisites:** Computer Networks

### Syllabus:

Module	Content	Hour	LO
<b>1</b>	Title: Introduction and overview of cloud computing. Objective: To understand the origin of cloud computing, cloud cube model, NIST model, characteristics of cloud, different deployment models, service models, advantages and	<b>2</b>	<b>2</b>
<b>2</b>	Title: To study and implement Hosted Virtualization using VirtualBox & KVM. Objective: To know the concept of Virtualization along with their types, structures and mechanisms. This experiment should have demonstration of creating and running Virtual machines inside hosted hypervisors like VirtualBox and KVM with their comparison based on various virtualization parameters. 2 1	<b>2</b>	<b>1</b>
<b>3</b>	Title: To study and Implement Bare-metal Virtualization using Xen, HyperV or VMware Esxi. Objective: To understand the functionality of Bare-metal hypervisors and their relevance in cloud computing platforms. This experiment should have demonstration of install, configure and manage Bare Metal hypervisor along with instructions to create and run virtual machines inside it. It should also emphasize on accessing VMs in different environments along with additional services provided by them like Load balancing, Auto-Scaling, Security etc.	<b>4</b>	<b>1</b>
<b>4</b>	Title: To study and Implement Infrastructure as a Service using AWS/Microsoft Azure. Objective: To demonstrate the steps to create and run virtual machines inside Public cloud platform. This experiment should emphasize on creating and running Linux/Windows Virtual machine inside Amazon EC2 or Microsoft Azure Compute and accessing them using RDP or VNC tools.	<b>4</b>	<b>2</b>
<b>5</b>	Title: To study and Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service. Objective: To demonstrate the steps to deploy Web applications or Web services written in different languages on AWS Elastic Beanstalk/ Microsoft Azure App Service.	<b>4</b>	<b>2</b>
<b>6</b>	Title: To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/ Azure Storage. Objective: To understand the concept of Cloud storage and to demonstrate the different types of storages like object storage, block level storages etc. supported by Cloud Platforms like Own Cloud/ AWS S3, Glaciers/ Azure Storage.	<b>4</b>	<b>2</b>

7	Title: To study and Implement Database as a Service on SQL/NOSQL databases like AWS RDS, AZURE SQL/ MongoDB Lab/ Firebase. Objective: To know the concept of Database as a Service running on cloud and to demonstrate the CRUD operations on different SQL and NOSQL databases running on cloud like AWS RDS, AZURE SQL/ Mongo Lab/ Firebase.	2	2
8	Title: To study and Implement Security as a Service on AWS/Azure Objective: To understand the Security practices available in public cloud platforms and to demonstrate various Threat detection, Data protection and Infrastructure protection services in AWS and Azure.	3	4
9	Title: To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud. Objective: To understand the working of Identity and Access Management IAM in cloud computing and to demonstrate the case study based on Identity and Access Management (IAM) on AWS/Azure cloud platform.	2	2
10	Title: To study and Implement Containerization using Docker Objective: To know the basic differences between Virtual machine and Container. It involves demonstration of creating, finding, building, installing, and running Linux/Windows application containers inside local machine or cloud platform.	4	6
11	Title: To study and implement container orchestration using Kubernetes Objective: To understand the steps to deploy Kubernetes Cluster on local systems, deploy applications on Kubernetes, creating a Service in Kubernetes, develop Kubernetes configuration files in YAML and creating a deployment in Kubernetes using YAML,	4	6
12	Mini-project: Design a Web Application hosted on public cloud platform [It should cover the concept of IaaS, PaaS, DBaaS, Storage as a Service, Security as a Service etc.]	4	3,5

## Lab Plan

Lab Outcome	List of Experiments	Lab session
<b>Week1</b>		
<b>02</b>	<b>Title:</b> Introduction and overview of cloud computing. <b>Objective:</b> To understand the origin of cloud computing, cloud cube model, NIST model, characteristics of cloud, different deployment models, service models, advantages and disadvantages.	<b>Session1</b> <b>Session2</b>
<b>Week2</b>		
<b>01</b>	<b>Title:</b> To study and implement Hosted Virtualization using VirtualBox& KVM. <b>Objective:</b> To know the concept of Virtualization along with their types, structures and mechanisms. This experiment should have demonstration of creating and running Virtual machines inside hosted hypervisors like	<b>Session1</b>

	VirtualBox and KVM with their comparison based on various virtualization parameters.	
01	<p><b>Title:</b> To study and Implement Bare-metal Virtualization using Xen, HyperV.</p> <p><b>Objective:</b> To understand the functionality of Bare-metal hypervisors and their relevance in cloud computing platforms. This experiment should have demonstration of install, configure and manage Bare Metal hypervisor along with instructions to create and run virtual machines inside it.</p>	Session2
<b>Week3</b>		
02	Introduction to AWS and account creation and Budget setting	Session1
02	<p><b>Title:</b> To study and Implement Infrastructure as a Service using AWS</p> <p><b>Objective:</b> To demonstrate the steps to create and run virtual machines inside public cloud platform. This experiment should emphasize on creating and running Linux/Windows Virtual machine inside Amazon EC2 or Microsoft Azure Compute and accessing them using RDP or VNC tools.</p>	Session 2
<b>Week4</b>		
02	Explore various commercially available cloud services. Introduction Google cloud and comparison with AWS	Session 1
02	<p><b>Title:</b> To study and Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.</p> <p><b>Objective:</b> To demonstrate the steps to deploy Web applications or Web services written in different languages on AWS Elastic Beanstalk/ Microsoft Azure App Service.</p>	Session 2
<b>Week5</b>		
02	<p><b>Title:</b> To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/ Azure Storage.</p> <p><b>Objective:</b> To understand the concept of Cloud storage and to demonstrate the different types of storages like object storage, block level storages etc. supported by Cloud Platforms like Own Cloud/ AWS S3, Glaciers/ Azure Storage.</p>	Session1
04	<p><b>Title:</b> To study and Implement Security as a Service on AWS/Azure</p> <p><b>Objective:</b> To understand the Security practices available in public cloud platforms and to demonstrate various Threat detection, Data protection and Infrastructure protection services in AWS and Azure.</p>	Session 2
<b>Week 6</b>		
04	<p><b>Title:</b> To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud.</p> <p><b>Objective:</b> To understand the working of Identity and Access Management IAM in cloud computing and to</p>	Session 1

	demonstrate the case study based on Identity and Access Management (IAM) on AWS/Azure cloud platform.	
05	Interaction with industry expert	Session 2
<b>Week 7</b>		
06	<b>Title:</b> To study and Implement Docker <b>Objective:</b> To understand the working of Docker PLAYHUB as a native registry for storing both public and private repositories.	Session 1
06	<b>Title:</b> To study and Implement Containerization using Docker <b>Objective:</b> To know the basic differences between Virtual machine and Container. It involves demonstration of creating, finding, building, installing, and running Linux/Windows application containers inside local machine or cloud platform.	Session 1
<b>Week 8</b>		
02,05	Explore salesforce as a SAAS <b>Objective:</b> To know <b>SaaS or Software as a Service</b> , which means there is no need to install the software or server to work on. Users can simply sign-up in Salesforce.com and can start running the business instantly.	Session 1 & 2
<b>Week 9</b>		
3,5	<b>Mini-project:</b> Design a Web Application hosted on public cloud platform [It should cover the concept of IaaS, PaaS, DBaaS, Storage as a Service, Security as a Service etc.]	Session 1 & 2

### Lab Outcomes (LO):

On successful completion of course learner will be able to:

- CSL605.1. Implement different types of virtualization techniques.
- CSL605.2. Analyze various cloud computing service models and implement them to solve the given problems.
- CSL605.3. Design and develop real world web applications and deploy them on commercial cloud(s).
- CSL605.4. Explain major security issues in the cloud and mechanisms to address them.
- CSL605.5. Explore various commercially available cloud services and recommend the appropriate one for the given application.
- CSL605.6. Implement the concept of containerization

**CO-PO Mapping:** (BL – Blooms Taxonomy, C – Competency, PI – Performance Indicator)

CO	BL	C	PI	PO	Mapping
<b>CSL605.1.</b> Implement different types of virtualization techniques.	1, 2, 3	1.4 Demonstrate competence in specialized engineering knowledge to the program	1.4.1 Apply theory and principles of Computer Science and engineering to solve an engineering problem	PO1, PO5	1
<b>CSL605.2.</b> Analyze various cloud computing service models and implement them to solve the given problems.	2, 4	2.2 Demonstrate an ability to formulate a solution plan and methodology for an engineering problem	2.2.2 Identify functionalities and computing resources.	PO2	1
		2.2	2.2.4	PO2	1
<b>CSL605.3.</b> Design and develop real world web applications and deploy them on commercial cloud(s).	2	3.1 Demonstrate an ability to define a complex/ open-ended problem in engineering terms 5.2 Demonstrate an ability to select and apply discipline-specific tools, techniques and resources	3.1.1 Able to define a precise problem statement with objectives and scope. 3.1.6 Able to develop software requirement specifications (SRS). 5.2.1 Identify the strengths and limitations of tools for (i) acquiring information, (ii) modelling and simulating, (iii) monitoring system performance, and (iv) creating engineering designs.	PO3 PO5	2
<b>CSL605.4.</b> Explain major security issues in the cloud and mechanisms to address them.	2	2.1 Demonstrate an ability to identify and formulate complex engineering problem	2.1.2 Identify processes/modules of a computer-based system and parameters to solve a problem	PO2	2
<b>CSL605.5.</b> Explore various commercially available cloud services and recommend the appropriate one for the given application	4	4.2 Demonstrate an ability to design experiments to solve open-ended problems	4.2.1 Design and develop appropriate procedures/methodologies based on the study objectives	PO4	3
<b>CSL605.6.</b> Implement the concept of containerization	1,2, 3	5.1 Demonstrate an ability to identify/create modern engineering tools, techniques and resources	5.1.2 Create/adapt/modify/extend tools and techniques to solve engineering problems	PO5	3

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
<b>CSL605.1</b>	3	2	2	2	2							1
<b>CSL605.2</b>	3	2	2	2	2							1
<b>CSL605.3</b>	3	2	2	2	2							1
<b>CSL605.4</b>	3	2	2	2	2							1
<b>CSL605.5</b>	3	2	2	2	2							1
<b>CSL605.6</b>	3	2	2	2	2							1

### CO-PSO Mapping:

CO	BL	C	PI	PO	Mapping
<b>CSC602.4.</b>	2	2.2 2.3 2.4	2.2.2 2.3.1 2.4.1	PSO1	3

	PSO 1	PSO 2
<b>CSL605.1.</b>	3	--
<b>CSL605.2.</b>	3	--
<b>CSL605.3.</b>	3	--
<b>CSL605.4.</b>	3	--
<b>CSL605.5.</b>	3	--
<b>CSL605.6.</b>	3	--

### CO Measurement Weightages for Tools:

<i>Course Outcomes</i>	<i>Direct Method (80%)</i>								<i>Indirect Method (20%)</i>	
	Lab	Assignments			Mini Project	Quizzes		Oral Exam	Course exit survey	
	1	1	2	3		1	2			
<b>CSL605.1</b>	10%	10%	--	--	10%	10%	--	60%	100%	
<b>CSL605.2</b>	10%	10%	--	--	10%	--	10%	60%	100%	
<b>CSL605.3</b>	10%	--	10%	--	20%	--	--	60%	100%	
<b>CSL605.4</b>	10%	--	10%	--	20%	--	--	60%	100%	
<b>CSL605.5</b>	20%	--	--	--	20%	--	--	60%	100%	

<b>CSL605.6</b>	20%	--	--	--	20%	--	--	60%	100%
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## Attainment:

### LO CSL605.1:

Direct Method

$$A_{CSL605.1D} = 0.1 * Lab + 0.1 * Assignment + 0.1 * Quizzes + 0.1 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.1} = 0.8 * A_{CSL605.1D} + 0.2 * A_{CSL605.1I}$$

### LO CSL605.2:

Direct Method

$$A_{CSL605.2D} = 0.1 * Lab + 0.1 * Assignment + 0.1 * Quizzes + 0.1 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.2} = 0.8 * A_{CSL605.2D} + 0.2 * A_{CSL605.2I}$$

### LO CSL605.3:

Direct Method

$$A_{CSL605.3D} = 0.1 * Lab + 0.1 * Assignment + 0.2 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.3} = 0.8 * A_{CSL605.3D} + 0.2 * A_{CSL605.3I}$$

### LO CSL605.4:

Direct Method

$$A_{CSL605.4D} = 0.1 * Lab + 0.1 * Assignment + 0.2 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.4} = 0.8 * A_{CSL605.4D} + 0.2 * A_{CSL605.4I}$$

### LO CSL605.5:

Direct Method

$$A_{CSL605.5D} = 0.2 * Lab + 0.2 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.5} = 0.8 * A_{CSL605.5D} + 0.2 * A_{CSL605.5I}$$

### LO CSL605.6

Direct Method

$$A_{CSL605.6D} = 0.2 * Lab + 0.2 * MiniProject + 0.6 * SEE\_Lab$$

Final Attainment:

$$A_{CSL605.6} = 0.8 * A_{CSL605.6D} + 0.2 * A_{CSL605.6I}$$

**Course Level Gap (if any): Nil**

**Content beyond Syllabus: Nil**

### *Practical Session Plan Comps B*

<i>Batch</i>	<i>Dates</i>		<i>Remarks</i>
	<i>Planned</i>	<i>Actual</i>	
<b>Experiment No. 1</b>			
<b>Title:</b> Introduction and overview of cloud computing.			
<b>Objective:</b> To understand the origin of cloud computing, cloud cube model, NIST model, characteristics of cloud, different deployment models, service models, advantages and disadvantages.			
A	23/01/2023, 26/01/2023	23/01/2023, 26/01/2023	26/01/2023(Thursday) Holiday
B	23/01/2023, 26/01/2023	23/01/2023, 26/01/2023	26/01/2023(Thursday) Holiday
C	23/01/2023, 25/01/2023	23/01/2023, 25/01/2023	
D	23/01/2023, 24/01/2023	23/01/2023, 24/01/2023	
<b>Experiment No. 2</b>			
<b>Title:</b> To study and implement Hosted Virtualization using VirtualBox& KVM.			
<b>Objective:</b> To know the concept of Virtualization along with their types, structures and mechanisms. This experiment should have demonstration of creating and running Virtual machines inside hosted hypervisors like VirtualBox and KVM with their comparison based on various virtualization parameters.			
A	30/01/2023, 02/02/2023	30/01/2023, 02/02/2023	
B	30/01/2023, 02/02/2023	30/01/2023, 02/02/2023	
C	30/01/2023, 01/02/2023	30/01/2023, 01/02/2023	
D	30/01/2023, 31/01/2023	30/01/2023, 31/01/2023	
<b>Experiment No. 3</b>			
<b>Title:</b> To study and Implement Bare-metal Virtualization using Xen, HyperV.			
<b>Objective:</b> To understand the functionality of Bare-metal hypervisors and their relevance in cloud computing platforms. This experiment should have demonstration of install, configure and manage Bare Metal hypervisor along with instructions to create and run virtual machines inside it.			
A	06/02/2023, 09/02/2023	06/02/2023, 09/02/2023	
B	06/02/2023, 09/02/2023	06/02/2023, 09/02/2023	
C	06/02/2023, 08/02/2023	06/02/2023, 08/02/2023	
D	06/02/2023, 07/02/2023	06/02/2023, 07/02/2023	
<b>Experiment No. 4</b>			
Introduction to AWS and account creation and Budget setting			
<b>Title:</b> To study and Implement Infrastructure as a Service using AWS			
A	13/02/2023, 16/02/2023	13/02/2023, 16/02/2023	
B	13/02/2023, 16/02/2023	13/02/2023, 16/02/2023	
C	13/02/2023, 15/02/2023	13/02/2023, 15/02/2023	
D	13/02/2023,14/02/2023	13/02/2023,14/02/2023	
<b>Experiment No.5</b>			
To study and Implement Platform as a Service using AWS Elastic Beanstalk/ Microsoft Azure App Service.			
A	20/02/2023, 23/02/2023	20/02/2023, 23/02/2023	



B	20/02/2023, 23/02/2023	20/02/2023, 23/02/2023	
C	20/02/2023, 22/02/2023	20/02/2023, 22/02/2023	
D	20/02/2023, 21/02/2023	20/02/2023, 21/02/2023	
<b>Experiment No. 6</b>			
<b>Title:</b> To study and Implement Storage as a Service using Own Cloud/ AWS S3, Glaciers/ Azure			
A	27/02/2023, 02/03/2023	27/02/2023, 02/03/2023	<b>UT 1</b>
B	27/02/2023, 02/03/2023	27/02/2023, 02/03/2023	<b>UT 1</b>
C	27/02/2023, 29/03/2023	27/02/2023, 29/03/2023	<b>UT 1</b>
D	27/02/2023, 28/03/2023	27/02/2023, 28/03/2023	<b>UT 1</b>
<b>Experiment No. 7</b>			
<b>Title:</b> To study and implement Identity and Access Management (IAM) practices on AWS/Azure cloud. Interaction with industry expert .			
<b>Objective:</b> To understand the concept of Cloud storage and to demonstrate the different types of storages like object storage, block level storages etc. supported by Cloud Platforms like Own Cloud/ AWS S3, Glaciers/ Azure Storage.			
A	06/03/2023, 09/03/2023	13/03/2023, 16/03/2023	<b>Sports Day / Holi</b>
B	06/03/2023, 09/03/2023	13/03/2023, 16/03/2023	<b>Sports Day / Holi</b>
C	06/03/2023, 08/03/2023	13/03/2023, 15/03/2023	<b>Sports Day / Holi</b>
D	06/03/2023, 07/03/2023	13/03/2023, 14/03/2023	<b>Sports Day / Holi</b>
<b>Experiment No. 8</b>			
<b>Title:</b> To study and Implement Security as a Service on AWS/Azure			
<b>Objective:</b> To understand the Security practices available in public cloud platforms and to demonstrate various Threat detection, Data protection and Infrastructure protection services in AWS and Azure.			
A	13/03/2023, 16/03/2023	13/03/2023, 16/03/2023	
B	13/03/2023, 16/03/2023	13/03/2023, 16/03/2023	
C	13/03/2023, 15/03/2023	13/03/2023, 15/03/2023	
D	13/03/2023, 14/03/2023	13/03/2023, 14/03/2023	
<b>Experiment No. 9</b>			
<b>Title:</b> To study and Implement Docker			
A	20/03/2023, 21/03/2023	20/03/2023, 21/03/2023	
B	20/03/2023, 21/03/2023	20/03/2023, 21/03/2023	
C	20/03/2023, 22/03/2023	20/03/2023, 22/03/2023	
D	20/03/2023, 21/03/2023	20/03/2023, 21/03/2023	
<b>Experiment No. 10</b>			
<b>Title:</b> To study and Implement Containerization using Docker			
A	27/03/2023, 30/03/2023	27/03/2023, 30/03/2023	

B	27/03/2023, 30/03/2023	27/03/2023, 30/03/2023	
C	27/03/2023, 29/03/2023	27/03/2023, 29/03/2023	
D	27/03/2023, 28/03/2023	27/03/2023, 28/03/2023	

### Text books:

1. Bernard Golden, “Amazon Web Services for Dummies”, John Wiley & Sons, Inc.
2. Michael Collier, Robin Shahan, “Fundamentals of Azure, Microsoft Azure Essentials”, Microsoft Press.
3. RajkumarBuyya, Christian Vecchiola, S ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw-Hill Education
4. Barrie Sosinsky, “Cloud Computing Bible”, Wiley publishing.
5. John Paul Mueller, “AWS for Admins for Developers”, John Wiley & Sons, Inc.
6. Ken Cochrane, Jeeva S. Chelladurai, NeependraKhare , “Docker Cookbook - Second Edition”, Packt publication.
7. Jonathan Baier, “Getting Started with Kubernetes-Second Edition”, Packt Publication.

### Term Work:

1. Term work should consist of 10 experiments and a mini project.
  2. Journal must include at least 2 assignments.
  3. The final certification and acceptance of term work ensures that satisfactory performance of laboratory work and minimum passing marks in term work.
  4. Total 50 Marks (Experiments: 15-marks, Mini project (Implementation) 15 marks, Mini Project Presentation & Report [for deployment, utilization, monitoring and billing] 10 Marks, Attendance 05-marks, Assignments: 05-marks)
- Oral examination will be based on Laboratory work, mini project and above syllabus

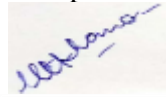
### Web References:

Sr. no.	Topic	Link
1	Introduction and overview of cloud computing	<a href="https://www.nist.gov/system/files/documents/itl/cloud/NIST_SP-500-291_Version2_2013_June18_FINAL.pdf">https://www.nist.gov/system/files/documents/itl/cloud/NIST_SP-500-291_Version2_2013_June18_FINAL.pdf</a>
2	Hosted Virtualization using KVM	<a href="https://phoenixnap.com/kb/ubuntu-installkvm/">https://phoenixnap.com/kb/ubuntu-installkvm/</a> 3 Baremetal Virtualization using Xen
3	Baremetal Virtualization using Xen	<a href="https://docs.citrix.com/en-us/xenserver/7-1/install.html">https://docs.citrix.com/en-us/xenserver/7-1/install.html</a>
4	IaaS, PaaS, STaaS, DbaaS, IAM and Security as a Service on AWS and Azure	1. AWS <a href="https://docs.aws.amazon.com/">https://docs.aws.amazon.com/</a> 2. MS Azure <a href="https://docs.microsoft.com/en-us/azure">https://docs.microsoft.com/en-us/azure</a>
5	Docker	<a href="https://docs.docker.com/get-started/">https://docs.docker.com/get-started/</a>
6	Kubernetes	<a href="https://kubernetes.io/docs/home/">https://kubernetes.io/docs/home/</a>

Verified by:

Programme Coordinator

Subject Expert



Jagruti N

