Lesson Plan No. 1.1	Course Name : Cloud Computing and Services Topic: Cloud Computing Overview	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define cloud computing. - Understand the basic concepts and importance of cloud computing. - Identify common uses of cloud computing.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Provide a brief definition of cloud computing. - Explain the significance of cloud computing in the modern IT landscape. - Share an example of a cloud computing application in daily life. **2. Development** (30 minutes) - Definition and Concept: - What is cloud computing? - Key characteristics of cloud computing. - Examples of cloud computing services (e.g., Google Drive, Dropbox). - Importance: - Scalability and flexibility benefits. - Cost-efficiency. - Accessibility from anywhere with internet connectivity. - Common Uses: - Storage solutions. - Software as a Service (SaaS). - Platform as a Service (PaaS). **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Cloud Computing Explained](https://aws.amazon.com/what-is-cloud-computing/) - [Introduction to Cloud Computing](https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/) YouTube Video: - [Introduction to Cloud Computing](https://www.youtube.com/watch?v=2LaAJq1lB0I)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1.What is cloud computing? 2.Name one benefit of cloud computing. 3. Give an example of a cloud computing service you use.

Lesson Plan No. 1.2	Course Name : Cloud Computing and Services Topic: History and Evolution of Cloud Computing	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Understand the historical background of cloud computing. - Learn about key milestones in the evolution of cloud computing. - Recognize the impact of these developments on modern computing.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the historical context of computing. - Highlight the transition from traditional to cloud-based computing. - Mention key pioneers in the development of cloud computing. **2. Development** (30 minutes) - Early Concepts: - Mainframe computing. - Time-sharing systems in the 1960s. - Milestones: - Development of the internet in the 1990s. - Introduction of web-based services. - Emergence of major cloud providers (e.g., AWS in 2006). - Impact: - Shift from physical servers to virtual environments. - Evolution of business models and service delivery. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [A Brief History of Cloud Computing](https://www.cloudflare.com/en-gb/learning/cloud/what-is-the-cloud/) - [The History and Evolution of Cloud Computing](https://www.digitalocean.com/community/tutorials/a-history-and-evolution-of-cloud-computing) YouTube Video: - [History and Evolution of Cloud Computing](https://www.youtube.com/watch?v=KkMPXT8SREE)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. What decade did the concept of time-sharing systems emerge? 2. When did AWS launch its first cloud services? 3. Name one key impact of cloud computing on modern IT.

Lesson Plan No. 1.3	Course Name : Cloud Computing and Services Topic: Grid Computing vs. Cloud Computing	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Differentiate between grid computing and cloud computing. - Understand the unique characteristics of each. - Identify scenarios where each is applicable.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Define grid computing and cloud computing. - Highlight their similarities and differences. - Provide a real-world example of each. **2. Development** (30 minutes) - Definitions: - Grid computing: Distributed computing model. - Cloud computing: On-demand resource availability over the internet. - Key Characteristics: - Grid computing: Resource sharing, collaboration across networks. - Cloud computing: Scalability, flexibility, and service models. - Applications: - Grid computing: Scientific research, large-scale computations. - Cloud computing: Business applications, data storage, and web services. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Grid Computing vs. Cloud Computing](https://www.ibm.com/cloud/learn/grid-computing) - [Differences Between Grid and Cloud Computing](https://www.geeksforgeeks.org/difference-between-grid-computing-and-cloud-computing/) YouTube Video: - [Grid Computing vs. Cloud Computing](https://www.youtube.com/watch?v=SGW_q-a4LjI)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is grid computing?

	2. Name one key characteristic of cloud computing. 3. Give an example of a scenario where grid computing is used.

Lesson Plan No. 1.4	Course Name : Cloud Computing and Services Topic: Cloud Components	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Identify the main components of cloud computing. - Understand the role of each component. - Learn how these components interact in a cloud environment.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the concept of cloud architecture. - Mention the key components involved. - Explain the importance of understanding these components. **2. Development** (30 minutes) - Main Components: - Infrastructure as a Service (IaaS): Virtual machines, storage. - Platform as a Service (PaaS): Development platforms. - Software as a Service (SaaS): Applications delivered over the web. - Roles: - IaaS: Provides basic infrastructure. - PaaS: Supports application development. - SaaS: Delivers software to end-users. - Interaction: - How these components work together. - Examples of popular services (AWS, Azure, Google Cloud). **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Cloud Computing Components](https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/) - [Introduction to Cloud Architecture](https://www.redhat.com/en/topics/cloud-computing/what-is-cloud-architecture) YouTube Video: - [Cloud Computing Explained](https://www.youtube.com/watch?v=f1gF2MgKL20)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:**

	1. What does IaaS stand for? 2. Name one example of a PaaS. 3. What is the primary function of SaaS?

Lesson Plan No. 1.5	Course Name : Cloud Computing and Services Topic: Essential Characteristics of Cloud Computing	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Identify essential characteristics of cloud computing. - Understand the importance of each characteristic. - Learn how these characteristics differentiate cloud computing from traditional IT models.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the essential characteristics of cloud computing. - Explain why these characteristics are important. - Provide a brief overview of each characteristic. **2. Development** (30 minutes) - Characteristics: - On-demand self-service: Users can provision resources as needed. - Broad network access: Accessible over the internet from any device. - Resource pooling: Shared resources dynamically allocated. - Importance: - Flexibility and scalability. - Cost savings. - Improved accessibility and collaboration. - Differentiation: - Compared to traditional IT models. - Benefits and efficiencies introduced by cloud computing. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Essential Characteristics of Cloud Computing](https://www.nist.gov/publications/nist-definition-cloud-computing) - [Cloud Computing Characteristics](https://www.ibm.com/cloud/learn/cloud-computing) YouTube Video: - [Essential Characteristics of Cloud Computing](https://www.youtube.com/watch?v=sqMEzuGJ_0A)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. What is on-demand self-service? 2. Name one advantage of broad network access. 3. What does resource pooling mean in the context of cloud computing?

Lesson Plan No. 1.6	Course Name : Cloud Computing and Services Topic: On-demand Self-service	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define on-demand self-service in cloud computing. - Understand its significance and benefits. - Learn how to utilize on-demand self-service effectively.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Define on-demand self-service. - Highlight its role in cloud computing. - Provide an example of on-demand self-service in action. **2. Development** (30 minutes) - Definition: - What on-demand self-service means. - Examples in cloud services (e.g., provisioning virtual machines). - Significance: - Reduces the need for manual intervention. - Increases efficiency and agility. - Empowers users to control their resources. - Utilization: - How to use on-demand self-service features. - Best practices for effective use. - Tools and platforms that support on-demand self-service. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [On-demand Self-service Explained](https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/) - [Understanding On-demand Self-service](https://www.ibm.com/cloud/learn/cloud-computing) YouTube Video: - [On-demand Self-service in Cloud Computing](https://www.youtube.com/watch?v=wZNkfo71gB8)

Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is on-demand self-service in cloud computing? 2. Name one benefit of on-demand self-service. 3. How does on-demand self-service increase efficiency?

Lesson Plan No. 1.7	Course Name : Cloud Computing and Services Topic: Comparing Cloud Providers	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Compare major cloud service providers. - Understand the unique features of each provider. - Learn how to choose the right provider based on specific needs.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce major cloud service providers (AWS, Azure, Google Cloud). - Explain the importance of comparing providers. - Provide a brief overview of each provider. **2. Development** (30 minutes) - Major Providers: - AWS: Wide range of services, global presence. - Azure: Integration with Microsoft products, enterprise solutions. - Google Cloud: Strong data analytics, AI capabilities. - Unique Features: - AWS: Comprehensive service portfolio. - Azure: Seamless integration with Windows Server, SQL Server. - Google Cloud: Advanced AI and machine learning tools. - Choosing the Right Provider: - Considerations: Cost, specific requirements, existing infrastructure. - Use case scenarios for each provider. - Decision-making tips. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Comparing Cloud Providers](https://aws.amazon.com/what-is-aws/) - [Cloud Providers Comparison](https://azure.microsoft.com/en-us/overview/what-is-azure/) YouTube Video: - [AWS vs Azure vs Google Cloud](https://www.youtube.com/watch?v=nKIu9yen5nc)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. Name the three major cloud service providers. 2. What is a key feature of Google Cloud? 3. Which provider offers strong integration with Microsoft products?

Lesson Plan No. 2.1	Course Name: Cloud Computing Topic: Architectural Influences: High-Performance Computing (HPC) in Cloud	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the concept of high-performance computing (HPC) in the cloud. - Explore how HPC uses cloud resources for computation-intensive tasks. - Learn the advantages and limitations of using HPC in cloud environments. - Analyze real-world applications of HPC in industries.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents
Teaching Development	**1. Introduction** (5 minutes) - Define HPC and its use for solving complex computational tasks. - How does HPC differ from regular cloud computing. - Types of industries benefitting most from HPC. - Primary challenges of integrating HPC into cloud environments. **2. Development** (30 minutes) - Introduction to HPC: Define HPC and its use for solving complex computational tasks. - Cloud and HPC: Discuss how cloud resources provide scalable solutions for HPC tasks. - Advantages of HPC in Cloud: Scalability: Cloud allows HPC to scale up or down based on the computation load. Cost-efficiency: Pay-as-you-go models help organizations save on infrastructure costs. Availability: Resources can be accessed globally with redundancy and failover mechanisms. - Challenges: Latency: HPC tasks may experience delays when transmitting large datasets to cloud servers. Compliance: Ensuring data confidentiality and regulatory compliance can be difficult when using third-party HPC resources. - Real-World Example: Examine how the Large Hadron Collider (LHC) at CERN uses cloud-based HPC to process massive amounts of data generated by particle collisions. Discuss how cloud HPC helps in speeding up analysis and reducing computational bottlenecks.. **3. Exercise (5 minutes) –** - Discuss with students how an organization in the healthcare industry could benefit from using HPC in the cloud to conduct large-scale genomic research.

	Ask students to identify potential limitations an aerospace company might face when using cloud-based HPC for simulations. Have students propose methods to mitigate latency issues in cloud-based HPC applications
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** • HPC in the Cloud [https://aws.amazon.com/hpc/] • HPC Use Cases [https://azure.microsoft.com/en-us/solutions/high-performance-computing/]
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.
	Reflective Questions: 1. How can cloud-based HPC transform industries that rely on large-scale simulations or data processing? 2. What are the risks associated with using cloud HPC for sensitive tasks? 3. How does cloud-based HPC benefit scientific research compared to traditional on-premise HPC solutions?

Lesson Plan No. 2.2	Course Name: Cloud Computing Topic: Utility and Enterprise Grid Computing	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the concept of utility computing and grid computing. - Learn how these architectures influence cloud computing. - Compare utility and enterprise grid computing with traditional cloud models. - Analyze use cases for grid computing in industries.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents
Teaching Development	**1. Introduction** (5 minutes) - Utility computing, and how does it relate to cloud services. - How grid computing is different from cloud computing. - Benefits of using grid computing for enterprises. **2. Development** (30 minutes) - Utility Computing: Introduce the pay-per-use model in utility computing. - Enterprise Grid Computing: Discuss how organizations leverage grid computing for large-scale resource sharing. - Benefits of Grid Computing: Cost savings: Organizations only pay for what they use, and grid computing can leverage idle computational power across multiple locations. Resource Sharing: Grid computing allows the pooling of resources from different sources for a common task, benefiting scientific communities and research institutions. - Challenges: Complex Management: Coordinating across different administrative domains can be difficult. Data Transfer Bottlenecks: Transmitting large amounts of data across grid nodes can cause delays. - Case Study: Discuss SETI@home, a volunteer-based grid computing project where idle resources from personal computers are used to analyze signals from space, searching for extraterrestrial intelligence **3. Exercise (5 minutes) –** - Ask students to compare the benefits of using grid computing over traditional cloud for scientific research. - Discuss a scenario where an enterprise uses both utility computing and grid computing. What challenges might they face? - Have students design a small grid computing network for academic research, identifying the key resources they would need.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. How does grid computing enhance collaboration across different organizations for a common goal? 2. What are the challenges of using grid computing compared to using a centralized cloud solution? 3. How can utility computing help organizations optimize their IT budgets?

Lesson Plan No. 2.3	Course Name: Cloud Computing Topic: Cloud Scenarios: Scalability and Simplicity	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the concept of scalability in cloud computing. - Learn how cloud services provide simplicity in operations. - Analyze the benefits of scalability and simplicity for businesses. - Explore cloud scalability models (vertical vs horizontal)..
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Cloud Scalability: Define and explain vertical and horizontal scaling. - Simplicity in Operations: Discuss cloud providers' simplified interfaces and automated resource management. **2. Development** (30 minutes) - Benefits: Scaling up resources during peak demand avoids downtime, while simplicity reduces the need for specialized IT expertise. - Challenges: Cost mismanagement can occur if scaling is not properly controlled. - Real-World Example: Examine how Netflix uses horizontal scaling to handle varying levels of traffic. **3. Exercise (5 minutes) –** - Analyze how horizontal scaling could benefit an e-commerce platform during high-demand periods like Black Friday. - Research the differences between vertical and horizontal scaling, providing examples. - Discuss how cloud simplicity could help a startup manage IT infrastructure with limited staff.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. How does scalability improve business resilience in cloud environments? 2. In what situations would vertical scaling be preferred over horizontal scaling? 3. What impact does cloud simplicity have on small and medium enterprises?

Lesson Plan No. 2.4	Course Name: Cloud Computing Topic: Cloud Vendors and Services	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Identify key cloud vendors and their offerings (AWS, Azure, Google Cloud). - Compare different cloud service models (IaaS, PaaS, SaaS). - Learn the advantages and disadvantages of each vendor's services. - Explore vendor-specific tools and platforms.
Teaching Aids (if any)	1. Power Point Presentation
Teaching Development	**1. Introduction** (5 minutes) - Introduction to Cloud Vendors: Discuss the market dominance of AWS, Azure, and Google Cloud Platform (GCP). - Cloud Service Models: Explain IaaS, PaaS, and SaaS with examples.. **2. Development** (30 minutes) - Vendor-Specific Tools: Overview of AWS Lambda, Azure AI, and Google Cloud's BigQuery. - Advantages and Disadvantages: AWS is best for IaaS but can be complex; Azure integrates well with Microsoft services; GCP is strong in analytics but has a smaller market share. - Real-World Example: Compare how Airbnb uses AWS for scalability and Dropbox uses GCP for improved storage. **3. Exercise (5 minutes) –** - Select a cloud vendor and research its service offerings for startups. Present the pros and cons. - Design a cloud architecture for a SaaS application using AWS, Azure, or GCP. - Discuss which cloud vendor would be most beneficial for a financial institution focused on security.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. How do cloud vendors differentiate their services in a competitive market? 2. What are the trade-offs between using AWS, Azure, and GCP for a growing business? 3. How do IaaS, PaaS, and SaaS meet the needs of different types of businesses?

Lesson Plan No. 2.5	Course Name: Cloud Computing Topic: Security and Limitations in Cloud Computing	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the security challenges of cloud computing. - Learn about the limitations of cloud services, including handling sensitive information. - Explore cloud security best practices. - Analyze real-world security breaches in cloud environments
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Cloud Security Risks: Data breaches, insider threats, and security misconfigurations. **2. Development** (30 minutes) - Handling Sensitive Information: Best practices for securing sensitive data in the cloud (e.g., encryption, MFA). - Limitations of Cloud Computing: Loss of control, data privacy concerns, and vendor lock-in. - Real-World Example: Examine the Capital One data breach and how stronger security measures could have prevented it. **3. Exercise (5 minutes) –** - Propose cloud security strategies to reduce data breach risks for a financial company. - Research the limitations of cloud services for high-latency applications. - Discuss the potential risks of vendor lock-in for businesses adopting cloud services.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What are the biggest security risks companies face when migrating to the cloud? 2. How can businesses ensure compliance with data privacy regulations in the cloud? **3.** How can companies mitigate the risk of vendor lock-in when choosing cloud providers?.

Lesson Plan No. 2.6	Course Name: Cloud Computing Topic: Application Development in the Cloud	Course Code: COM-701(A)
Objectives	At the end of the lesson the student shall be able to: - Understand how application development differs in cloud environments. - Learn about the benefits and challenges of developing cloud-native applications. - Explore best practices for cloud application development.	
Teaching Aids (if any)	1. Power Point Presentation	
Teaching Development	**1. Introduction** (5 minutes) - Cloud-Native Applications: Define cloud-native applications using microservices and containerization. **2. Development** (30 minutes) - Challenges: Vendor lock-in and performance optimization. - Real-World Example: Discuss how Spotify uses a microservices architecture on the Google Cloud Platform. - Best Practices: API-first design and continuous integration/continuous delivery (CI/CD). **3. Exercise (5 minutes) –** - Design a cloud-native application for a social media platform, focusing on microservices and API-first development. - Discuss how a company could mitigate the challenges of vendor lock-in for cloud-native applications. - Analyze a cloud-native development platform (AWS, GCP, Azure) and discuss its pros and cons for a small business.	
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings	
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. Reflective Questions: 1. What are the key advantages of using microservices in cloud-native application development? 2. How can companies balance the flexibility of cloud-native applications with the risk of vendor lock-in? 3. What best practices should developers follow when building cloud-native applications?	

Lesson Plan No. 2.7	Course Name: Cloud Computing Topic: Security Benefits and Levels for Third-Party Applications	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the security benefits of cloud platforms for third-party applications. - Learn about the different security levels and compliance standards in the cloud. - Explore the challenges of managing third-party applications securely.
Teaching Aids (if any)	1. Power Point Presentation
Teaching Development	**1. Introduction** (5 minutes) - Security Benefits: Cloud providers offer pre-configured security features (e.g., encryption, IAM, compliance certifications). **2. Development** (30 minutes) - Security Levels: Application-level security (secure coding, API protections), network-level security (VPNs, firewalls), and compliance standards (GDPR, PCI-DSS). - Challenges: Ensuring third-party vendors comply with data privacy regulations and managing the shared responsibility model. - Real-World Example: Discuss how Salesforce integrates third-party applications securely using multi-factor authentication and encryption. **3. Exercise (5 minutes) –** - Design a secure integration strategy for a third-party billing system in the cloud, addressing data privacy concerns. - Analyze the shared responsibility model and discuss what security tasks are the responsibility of the cloud provider vs the customer. - Discuss how GDPR compliance impacts third-party application development on cloud platforms.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. How can cloud platforms ensure the security of third-party applications? 2. What challenges arise when integrating third-party apps into cloud environments? 3. How does GDPR compliance affect the development and management of third-party cloud applications?.

Lesson Plan No. 2.8	Course Name: Cloud Computing Topic: Regulatory Issues and Government Policies in Cloud Computing	Course Code: COM-701(A)

Objectives	At the end of the lesson the student shall be able to: - Understand the regulatory and legal challenges in cloud computing. - Learn about government policies that affect cloud adoption. - Explore the role of data privacy regulations such as GDPR and HIPAA. - Analyze the implications of non-compliance for cloud service providers..
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Regulatory Challenges: Data sovereignty, compliance standards (GDPR, HIPAA, PCI-DSS), and cross-border data transfers. **2. Development** (30 minutes) - Government Policies: Cloud adoption frameworks (e.g., India's MeghRaj cloud initiative), public sector cloud guidelines. - Real-World Example: Analyze how Google Cloud and Microsoft Azure adapted services to comply with GDPR by offering data localization and access management. **3. Exercise (5 minutes) –** - Evaluate how a multinational company can comply with GDPR while using a US-based cloud provider. - Research government cloud policies in your region and discuss how they affect cloud service adoption in public institutions. - Discuss the penalties and risks for cloud providers that fail to comply with regulations such as GDPR and HIPAA.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings
Evaluation	Reflective Questions: 1. How do government policies shape the adoption of cloud services in public and private sectors? 2. What challenges do businesses face when complying with multiple regulatory frameworks across regions? 3. How can cloud providers ensure compliance with global data privacy regulations?

Lesson Plan No. 3.1	Course Name: Cloud Computing and Services Topic: Introduction to Cloud Computing Architecture	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define cloud computing and its architecture. - Understand the significance of cloud architecture in modern IT. - Identify the basic components of cloud computing architecture.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Briefly define cloud computing and its purpose. - Explain why cloud architecture is critical for IT infrastructure. - Mention a real-world example of a company leveraging cloud architecture. **2. Development** (30 minutes) - Definition and Components of Cloud Computing: - Define cloud computing and its layers. - Highlight essential components such as virtualization, servers, storage. - Discuss cloud services like SaaS, PaaS, and IaaS. - Historical Evolution of Cloud Computing: - Trace the history from mainframes to modern cloud solutions. - Discuss the role of virtualization in cloud evolution. - Explain the impact of internet growth on cloud computing. - Importance in Modern IT: - Discuss cost-efficiency and scalability benefits. - Highlight examples of cloud adoption in various industries. - Explain how cloud computing supports remote work and collaboration. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Introduction to Cloud Computing](https://www.ibm.com/cloud/learn/cloud-computing) - [Cloud Computing Basics](https://azure.microsoft.com/en-us/overview/what-is-cloud-computing/) YouTube Video Reference: - [What is Cloud Computing? - YouTube](https://www.youtube.com/watch?v=2LaAJq1lB1Q)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. What is cloud computing? 2. Name one key component of cloud computing architecture. 3. How does cloud computing benefit modern IT infrastructure?

Lesson Plan No. 3.2	Course Name: Cloud Computing and Services Topic: Layers in Cloud Architecture	Course No.: COM-701

Objectives	At the end of the lesson the student shall be able to: - Identify the various layers in cloud computing architecture. - Understand the function of each layer. - Explain the interaction between layers.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the concept of layered architecture in cloud computing. - Explain why layered architecture is important. - Provide a high-level overview of each layer. **3. Development** (30 minutes) - Physical Layer: - Define the physical layer. - Discuss components like servers, storage devices, and networking. - Explain the role of data centers. - Virtual Layer: - Define the virtual layer. - Discuss virtualization technologies and hypervisors. - Explain how virtualization abstracts physical resources. - Service Layer: - Define the service layer. - Discuss services like SaaS, PaaS, and IaaS. - Explain how these services interact with the underlying layers. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Cloud Architecture Layers](https://aws.amazon.com/architecture/) - [Understanding Cloud Layers](https://www.redhat.com/en/topics/cloud-computing/what-is-cloud-architecture) YouTube Video Reference: - [Cloud Computing Architecture - YouTube](https://www.youtube.com/watch?v=WzSM8sTQ6Io)

Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is the physical layer in cloud architecture? 2. Name a technology used in the virtual layer. 3. What services are provided by the service layer?

Lesson Plan No. 3.3	Course Name: Cloud Computing and Services Topic: Cloud Delivery Models	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define different cloud delivery models. - Understand the pros and cons of each model. - Identify real-world applications of each model.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce cloud delivery models. - Explain the significance of delivery models in cloud computing. - Provide examples of companies using different delivery models. **3. Development** (30 minutes) - Infrastructure as a Service (IaaS): - Define IaaS. - Discuss its benefits and challenges. - Provide examples of IaaS providers. - Platform as a Service (PaaS): - Define PaaS. - Discuss its benefits and challenges. - Provide examples of PaaS providers. - Software as a Service (SaaS): - Define SaaS. - Discuss its benefits and challenges. - Provide examples of SaaS providers. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Cloud Delivery Models](https://azure.microsoft.com/en-us/overview/what-are-iaas-paas-saas/) - [Understanding Cloud Services](https://www.ibm.com/cloud/learn/iaas-paas-saas) - YouTube Video Reference: - [Cloud Service Models - YouTube](https://www.youtube.com/watch?v=7a9nOwFpYxI)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is IaaS?

	2. Name a benefit of using PaaS. 3. Give an example of a SaaS provider.

Lesson Plan No. 3.4	Course Name: Cloud Computing and Services Topic: The SPI Framework	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define the SPI framework in cloud computing. - Understand the components of the SPI framework. - Explain the significance of the SPI framework in cloud services.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the SPI framework. - Explain why the SPI framework is important. - Provide a high-level overview of the components. **3. Development** (30 minutes) - Service: - Define service in the SPI framework. - Discuss different types of services. - Explain the importance of service-level agreements (SLAs). - Platform: - Define platform in the SPI framework. - Discuss platform components like middleware and runtime environments. - Explain the role of platforms in application development. - Infrastructure: - Define infrastructure in the SPI framework. - Discuss infrastructure components like servers, storage, and networking. - Explain how infrastructure supports cloud services. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [The SPI Framework](https://www.techopedia.com/definition/29454/spi-service-platform-infrastructure) - [Understanding SPI in Cloud](https://www.cloudopedia.com/spi-model/) - YouTube Video Reference: - [SPI Framework in Cloud Computing - YouTube](https://www.youtube.com/watch?v=sIkr6dA7W9Y)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What does SPI stand for? 2. Name a component of the platform layer.

	3. Why are SLAs important in cloud services?

Lesson Plan No. 3.5	Course Name: Cloud Computing and Services Topic: Cloud Platform as a Service (PaaS)	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define PaaS. - Understand the advantages and disadvantages of PaaS. - Identify examples of PaaS platforms.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce PaaS and its significance. - Explain the basic concept of PaaS. - Mention a few popular PaaS platforms. **3. Development** (30 minutes) - Definition and Characteristics: - Define PaaS. - Discuss the key characteristics of PaaS. - Explain the development environment provided by PaaS. - Advantages and Disadvantages: - Discuss the benefits of PaaS like streamlined development and scalability. - Highlight the potential drawbacks like vendor lock-in. - Provide examples of scenarios where PaaS is beneficial. - Examples of PaaS Platforms: - List popular PaaS platforms like Microsoft Azure, Google App Engine. - Discuss the features of these platforms. - Explain how these platforms support application development. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [What is PaaS?](https://azure.microsoft.com/en-us/overview/what-is-paas/) - [PaaS Explained](https://www.ibm.com/cloud/learn/paas) 7. YouTube Video Reference: - [What is PaaS? - YouTube](https://www.youtube.com/watch?v=wbVglLLwOiE)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:**

	1. What is PaaS? 2. Name one advantage of PaaS. Give an example of a PaaS platform.

Lesson Plan No. 3.6	Course Name: Cloud Computing and Services Topic: Cloud Software as a Service (SaaS)	Course No.: COM -701
Objectives	At the end of the lesson the student shall be able to: - Define SaaS. - Understand the advantages and disadvantages of SaaS. - Identify examples of SaaS providers.	
Teaching Aids (if any)	1. Power Point Presentation 2. Youtube Videos	
Teaching Development	**1. Introduction** (5 minutes) - Introduce SaaS and its importance. - Explain the basic concept of SaaS. - Mention a few popular SaaS providers. **3. Development** (30 minutes) - Definition and Characteristics: - Define SaaS. - Discuss the key characteristics of SaaS. - Explain the infrastructure provided by SaaS. - Advantages and Disadvantages: - Discuss the benefits of SaaS like cost savings and Accessibility. - Highlight the potential drawbacks like managing security. - Provide examples of scenarios where SaaS is beneficial. - Examples of SaaS Providers: - List popular SaaS providers like Salesforce, Google Workspace, Microsoft 365, Zoom. - Discuss the features of these providers. - Differentiates SaaS from traditional software models. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.	
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [What is SaaS?](https://aws.amazon.com/what-is-saas/) - [SaaS Explained](https://www.ibm.com/cloud/learn/saas) - YouTube Video Reference: - [What is SaaS? - YouTube](https://www.youtube.com/watch?v=5-4blibWcJY)	

Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. In what scenarios do you think SaaS is most beneficial, and why? 3. What tools are essential for effective collaboration in a remote work environment? 3. What security measures do you think are essential for businesses using SaaS? 4. What new trends in SaaS do you think will emerge, and how might they influence businesses?

Lesson Plan No. 3.7	Course Name: Cloud Computing and Services Topic: Cloud Infrastructure as a Service (IaaS)	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define IaaS. - Understand the advantages and disadvantages of IaaS. - Identify examples of IaaS providers.
Teaching Aids (if any)	3. Power Point Presentation 4. Youtube Videos
Teaching Development	**2. Introduction** (5 minutes) - Introduce IaaS and its importance. - Explain the basic concept of IaaS. - Mention a few popular IaaS providers. **3. Development** (30 minutes) - Definition and Characteristics: - Define IaaS. - Discuss the key characteristics of IaaS. - Explain the infrastructure provided by IaaS. - Advantages and Disadvantages: - Discuss the benefits of IaaS like cost savings and scalability. - Highlight the potential drawbacks like managing security. - Provide examples of scenarios where IaaS is beneficial. - Examples of IaaS Providers: - List popular IaaS providers like AWS, Google Cloud, Microsoft Azure. - Discuss the features of these providers. - Explain how these providers support infrastructure needs. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** a. [What is IaaS?](https://aws.amazon.com/what-is-iaas/) b. [IaaS Explained](https://www.ibm.com/cloud/learn/iaas) c. YouTube Video Reference: d. [What is IaaS? - YouTube](https://www.youtube.com/watch?v=5-4blibWcJY)

Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is IaaS? 2. Name one advantage of IaaS. 3. Give an example of an IaaS provider.

Lesson Plan No. 3.8	Course Name: Cloud Computing and Services and ServicesTopic: Cloud Deployment Models	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define various cloud deployment models. - Understand the advantages and disadvantages of each model. - Identify examples of each deployment model.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce cloud deployment models. - Explain the significance of deployment models in cloud computing. - Provide examples of companies using different deployment models. **3. Development** (30 minutes) - Public Clouds: - Define public clouds. - Discuss the benefits and challenges of public clouds. - Provide examples of public cloud providers. - Private Clouds: - Define private clouds. - Discuss the benefits and challenges of private clouds. - Provide examples of private cloud implementations. - Community Clouds: - Define community clouds. - Discuss the benefits and challenges of community clouds. - Provide examples of community cloud use cases. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [Cloud Deployment Models](https://www.ibm.com/cloud/learn/cloud-deployment-models) - [Understanding Cloud Deployment Models](https://azure.microsoft.com/en-us/overview/what-are-private-public-hybrid-clouds/) - YouTube Video Reference: - [Cloud Deployment Models - YouTube](https://www.youtube.com/watch?v=_g3zJvGH7Us)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. What is a public cloud? 2. Name one benefit of private clouds. 3. Give an example of a community cloud use case.

Lesson Plan No. 3.9	Course Name: Cloud Computing and Services Topic: Public Clouds	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define public clouds. - Understand the advantages and disadvantages of public clouds. - Identify examples of public cloud providers.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the concept of public clouds. - Explain why public clouds are popular. - Mention a few public cloud providers. **3. Development** (30 minutes) - Definition and Characteristics: - Define public clouds. - Discuss the key characteristics of public clouds. - Explain the shared infrastructure in public clouds. - Advantages and Disadvantages: - Discuss the benefits of public clouds like cost savings and scalability. - Highlight the potential drawbacks like security concerns. - Provide examples of scenarios where public clouds are beneficial. - Examples of Public Cloud Providers: - List popular public cloud providers like AWS, Google Cloud, Microsoft Azure. - Discuss the features of these providers. - Explain how these providers support various business needs. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [What is a Public Cloud?](https://aws.amazon.com/what-is-cloud-computing/) - [Public Cloud Explained](https://www.ibm.com/cloud/learn/public-cloud) - YouTube Video Reference: - [What is a Public Cloud? - YouTube](https://www.youtube.com/watch?v=7TFH2JlzI4M)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 2. What is a public cloud? 3. Name one advantage of public clouds. 4. Give an example of a public cloud provider.

Lesson Plan No. 3.10	Course Name: Cloud Computing and Services Topic: Hybrid Clouds	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define hybrid clouds. - Understand the advantages and disadvantages of hybrid clouds. - Identify examples of hybrid cloud implementations.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) - Introduce the concept of hybrid clouds. - Explain the significance of hybrid clouds in modern IT. - Provide examples of companies using hybrid clouds. **3. Development** (30 minutes) - Definition and Characteristics: - Define hybrid clouds. - Discuss the key characteristics of hybrid clouds. - Explain the integration of public and private clouds in hybrid models. - Advantages and Disadvantages: - Discuss the benefits of hybrid clouds like flexibility and cost savings. - Highlight the potential drawbacks like complexity in management. - Provide examples of scenarios where hybrid clouds are beneficial. - Examples of Hybrid Cloud Implementations: - List companies using hybrid clouds. - Discuss the features of their hybrid cloud solutions. - Explain how hybrid clouds support their business operations. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - [What is a Hybrid Cloud?](https://azure.microsoft.com/en-us/overview/what-is-hybrid-cloud-computing/) - [Hybrid Cloud Explained](https://www.ibm.com/cloud/learn/hybrid-cloud) 7. YouTube Video Reference: - [What is a Hybrid Cloud? - YouTube](https://www.youtube.com/watch?v=2SXVoLU96nE)
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer.

	Reflective Questions: 1. What is a hybrid cloud? 2. Name one advantage of hybrid clouds. 3. Give an example of a company using a hybrid cloud.

Lesson Plan No. 4.1	Course Name: Cloud Computing and Services Topic: Federated Learning	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define federated learning and its key concepts. - Understand the significance of federated learning in data privacy and collaborative learning. - Identify the basic components and architecture of federated learning.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**2. Introduction** (5 minutes) Briefly define federated learning and its purpose in the context of machine learning. Discuss the importance of data privacy and how federated learning addresses this issue. Mention a real-world example of a company using federated learning (e.g., Google's keyboard prediction). **3. Development** (30 minutes) - Definition and Key Concepts: - Define federated learning and its unique features compared to traditional machine learning. - Explain the concepts of local training and model aggregation. - Architecture of Federated Learning: - Describe the architecture, including clients (data sources) and a central server. - Highlight essential components such as local models, global model, and communication protocols. - Benefits of Federated Learning: - Discuss data privacy, reduced data transfer, and personalization. - Provide examples of federated learning applications in healthcare, finance, and mobile devices. - Challenges in Federated Learning: - Address issues like data heterogeneity, communication efficiency, and security concerns. **Activity (10 minutes)** **4. Group Discussion:** - Divide students into small groups and ask them to brainstorm applications of federated learning in various fields. Each group will share their ideas with the class. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - Federated Learning: Challenges, Methods, and Future Directions - What is Federated Learning? - YouTube - **YouTube Videos:** - "Federated Learning Explained" by Two Minute Papers. - A concise video that explains the concept and significance of federated learning in an easy-to-understand manner. - "Federated Learning: The Future of AI?" by MIT Technology Review. - This video discusses the implications of federated learning for artificial intelligence and data privacy. -
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. Reflective Questions: 1. What is federated learning, and how does it differ from traditional machine learning? 2. Name one key benefit and one challenge of federated learning. 3. In what ways can federated learning improve data privacy in applications?

Lesson Plan No. 4.2	Course Name: Cloud Computing and Services Topic: Architecture of Federated Cloud Computing	Course No.: COM-701

Objectives	At the end of the lesson the student shall be able to: - Define federated cloud computing and its key concepts. - Understand the architecture and components of federated cloud systems. - Discuss the benefits and challenges of federated cloud computing.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) Define federated cloud computing and its relevance in modern IT. Briefly discuss how federated cloud computing differs from traditional cloud computing. Introduce a real-world example (e.g., collaborative research initiatives). **2. Development** (30 minutes) **Key Concepts:** -Explain the concept of federation in cloud computing. -Discuss data sovereignty and how federated cloud computing addresses compliance issues. **Architecture Overview:** -Describe the layered architecture of federated cloud computing, including: -Client Layer: End-users and devices accessing services. -Federation Layer: Mechanisms for resource sharing and collaboration among different cloud providers. -Service Layer: Cloud services (IaaS, PaaS, SaaS) offered through federation. -Infrastructure Layer: The physical and virtual resources (servers, storage, networks) managed across federated clouds. Use diagrams to illustrate the architecture visually. **Components of Federated Cloud Architecture:** -Discuss key components, such as: • Federated identity management • Data management and orchestration • Security and compliance measures **Benefits of Federated Cloud Computing:** -Discuss advantages, including improved resource utilization, data privacy, and flexibility. **Challenges:** Highlight issues like interoperability, governance, and data transfer latency.

	3. Exercise (5 minutes) – - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings:** "Federated Cloud Computing: A New Paradigm for Cloud Services" - Research papers or articles that cover the principles and case studies. "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl - A foundational book that includes information relevant to federated architectures. **HomeWork:** • Write a reflective essay on the significance of federated computing architecture in enhancing data privacy and collaboration across organizations. Consider: • The implications for industries such as healthcare or finance. • Any ethical considerations associated with federated computing.
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is federated cloud computing, and why is it important? 2. Describe one key component of federated cloud architecture. 3. What are some challenges faced in implementing federated cloud computing

Lesson Plan No. 4.3	Course Name: Cloud Computing and Services Topic: SLA Overview	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define Service Level Agreements (SLAs) and their key concepts. - Understand the components and types of SLAs. - Discuss the benefits and challenges associated with SLAs in cloud computing..
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) Define SLAs and explain their relevance in cloud computing and IT services. Briefly discuss the difference between formal SLAs and informal agreements. Introduce a real-world example (e.g., SLAs from major cloud providers like AWS or Azure) **2. Development** (30 minutes) **Key Concepts:** Explain the purpose of SLAs and the key terms involved (e.g., uptime, response time, penalties). Discuss how SLAs ensure accountability between service providers and customers. **Components of SLAs:** Describe the essential components, including: Service Description: Outline of the services covered. Performance Metrics: Key performance indicators (KPIs) used to measure service quality. Responsibilities: Roles and responsibilities of both parties. Penalties and Remedies: Consequences for failing to meet SLA terms. **Types of SLAs:** Discuss different types, such as: Service-based SLAs: Focus on a specific service offered. Customer-based SLAs: Tailored to a specific customer. Multi-level SLAs: Combine different types for various services or customers. **Benefits of SLAs:** Discuss advantages, including clarity of expectations, improved service quality, and enhanced customer satisfaction. Challenges: Highlight issues like ambiguous terms, enforcement difficulties, and changing requirements.

	3. Exercise (5 minutes) - Ask students to share their thoughts on what makes a good SLA and discuss examples from their experiences.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings - **Suggested Readings:** • "Service Level Agreements for Cloud Computing" - Research papers or articles covering principles and best practices. • Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl - A foundational book that includes information on SLAs. -
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is a Service Level Agreement (SLA), and why is it important? 2. Describe one key component of an SLA. 3. What are some common challenges faced in creating and enforcing SLAs?

Lesson Plan No. 4.4	Course Name: Cloud Computing and Services Topic: SLA management in cloud computing	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define SLA management and its importance in cloud computing. - Identify the key components and metrics involved in SLA management. - Discuss the best practices and challenges associated with managing SLAs in cloud environments.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) Define SLA management and explain its significance in cloud computing. Discuss how effective SLA management can enhance service quality and customer satisfaction. Introduce a real-world example (e.g., a major cloud provider's SLA management practices) **2. Development** (30 minutes) **Key Concepts:** Explain the concept of SLAs in the context of cloud services. Discuss the relationship between SLAs and service quality, focusing on key performance indicators (KPIs). **Components of SLA Management:** Describe essential components involved in managing SLAs, including: Service Level Objectives (SLOs): Specific measurable goals within SLAs. Monitoring and Reporting: Tools and techniques for tracking performance against SLAs. Compliance and Enforcement: Mechanisms for ensuring adherence to SLA terms. Review and Revision: Processes for regularly assessing and updating SLAs. SLA Metrics: Discuss common metrics used in SLA management, such as: Uptime/downtime percentages Response times for support tickets Throughput and latency **Best Practices for SLA Management:** Outline best practices, such as: Establishing clear, measurable objectives. Regularly reviewing SLA performance and customer feedback. Collaborating closely with service providers and stakeholders. Challenges in SLA Management: Highlight common challenges, including:

	Ambiguity in SLA terms. Difficulties in measuring compliance. Managing expectations between customers and providers. **3. Exercise (5 minutes) –** - Engage students in a discussion about their experiences with SLAs. Ask them to share examples of effective or ineffective SLA management.
Closure	Summarize the key points from the lesson. Conduct a quick Q&A session to reinforce understanding. **Suggested Readings:** • "Service Level Agreements for Cloud Computing" - Research papers or articles covering principles and best practices. • "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl - A foundational text that includes information on SLA management. **Homework:** • Write a reflective essay (300-500 words) on the importance of SLA management in cloud computing. • Consider The role of SLAs in maintaining customer trust and satisfaction. Challenges that organizations face in managing SLAs and how to overcome them.
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is SLA management, and why is it crucial for cloud computing? 2. Name one key component of effective SLA management. 3. What challenges might an organization encounter when managing SLAs, and how can they address these challenges?

Lesson Plan No. 4.5	Course Name: Cloud Computing and Services Topic: HPC Introduction	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define high-performance computing (HPC) and its significance. - Understand the basic architecture and components of HPC systems. - Discuss applications and benefits of HPC in various fields.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Define HPC and explain its importance in solving complex computational problems. -Briefly discuss the evolution of HPC, from early supercomputers to modern distributed computing. -Introduce a real-world example of an HPC application (e.g., climate modeling, genomic research). **2. Development** (30 minutes) **-Key Concepts:** Explain what constitutes HPC, including parallel processing and the use of multiple processors. Discuss the difference between HPC and traditional computing. **-Architecture of HPC Systems:** Describe the fundamental components of HPC architecture, including: Nodes: Individual computing units (CPUs/GPUs) within an HPC system. Interconnects: Communication systems that link nodes (e.g., InfiniBand, Ethernet). Storage Systems: High-speed storage solutions for managing large datasets. Software Stack: Tools and libraries for programming and job scheduling (e.g., MPI, SLURM). **-Types of HPC Systems:** Discuss different types of HPC architectures, such as: Cluster computing Grid computing Cloud-based HPC **-Applications of HPC:** Highlight various fields where HPC is applied, including: Scientific research (e.g., simulations, modeling) Engineering (e.g., computational fluid dynamics) Healthcare (e.g., drug discovery, bioinformatics) Financial modeling (e.g., risk analysis, forecasting)

	-Benefits of HPC: Discuss advantages, including faster computations, ability to handle large datasets, and enhanced research capabilities. **2. Exercise (5 minutes) –** -Engage students in a brief discussion: Ask them to think of additional applications of HPC in their fields of interest and share their ideas.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings. **Suggested Readings:** • "High-Performance Computing: Paradigm and Infrastructure" - Research papers or articles on HPC principles and infrastructure. • "Introduction to High-Performance Computing for Scientists and Engineers" by Georg Hager and Gerhard Wellein - A foundational text on HPC concepts and applications.
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is high-performance computing, and why is it important? 2. Describe one key component of HPC architecture. **3.** How does HPC benefit scientific research and innovation?

Lesson Plan No. 4.6	Course Name: Cloud Computing and Services Topic: Performance prediction for HPC on cloud	Course No.: COM -701
Objectives	At the end of the lesson the student shall be able to: - Define performance prediction in the context of High-Performance Computing (HPC) on cloud platforms. - Understand the significance of performance prediction for optimizing resource utilization. - Identify common techniques and tools used for performance prediction in cloud environments..	
Teaching Aids (if any)	1. Power Point Presentation 2. Youtube Videos	
Teaching Development	- **Introduction** (5 minutes) -Define performance prediction and its relevance in HPC, especially in cloud computing. -Discuss the importance of accurate performance prediction for resource management and cost efficiency. -Introduce a real-world example, such as performance prediction in a cloud-based simulation for weather forecasting. **2. Development** (30 minutes) **Key Concepts:** -Explain the challenges of performance prediction in cloud HPC environments, including variability in cloud resources. -Discuss the difference between performance prediction and performance monitoring. **Techniques for Performance Prediction:** -Describe common methods, including: Benchmarking: Using standard benchmarks to evaluate system performance. Modeling: Creating mathematical models to predict performance based on historical data. Simulation: Using simulation tools to estimate performance under various workloads. Machine Learning: Applying ML algorithms to predict performance based on patterns in data. **Tools for Performance Prediction:** -Highlight popular tools and frameworks, such as: -CloudSim: A framework for modelling and simulating cloud computing environments. -SPECCPU: A benchmark suite for CPU performance evaluation. -HPC Performance Toolkit: Tools for analyzing and predicting performance in HPC applications. **Benefits of Performance Prediction:** Discuss advantages, such as improved resource allocation, reduced costs, and enhanced application performance. Challenges in Performance Prediction:	

	Address issues like variability in cloud environments, data availability, and the complexity of workloads. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings. **Suggested Readings:** • "Performance Prediction in Cloud Computing" - Research articles or papers discussing methodologies and case studies. • "High-Performance Computing: Paradigm and Infrastructure" - A foundational text that includes relevant sections on performance prediction. **You Tube Reference:** https://www.youtube.com/watch?v=E6knVguC1Nc
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:**? 1. What is performance prediction in the context of HPC on the cloud, and why is it critical for effective resource management? 2. How do different factors (such as workload type, network latency, and resource availability) influence performance predictions for HPC applications? 3. Who are the stakeholders involved in performance prediction for HPC on the cloud, and what are their specific interests and needs?

Lesson Plan No. 4.7	Course Name: Cloud Computing and Services Topic: Data Security in the Cloud	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define data security and its importance in cloud computing. - Discuss the potential risks and consequences of data breaches in cloud environments. - Introduce a real-world example of a notable data breach (e.g., Equifax or Capital One) and its impact.
Teaching Aids (if any)	3. Power Point Presentation 4. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) Define data security and its importance in cloud computing. Discuss the potential risks and consequences of data breaches in cloud environments. Introduce a real-world example of a notable data breach (e.g., Equifax or Capital One) and its impact. **2. Development** (30 minutes) - **Understanding Cloud Security:** - Differentiate between data security and overall cloud security. - Explain the shared responsibility model in cloud security. - **Common Threats and Vulnerabilities**: - Discuss threats such as data breaches, data loss, account hijacking, and insider threats. Explore vulnerabilities like insecure APIs, misconfigurations, and lack of encryption. -**Best Practices for Data Security:** -Encryption: Importance of encrypting data at rest and in transit. -Access Control: Implementing identity and access management (IAM) to control permissions. -Regular Audits and Monitoring: Emphasizing the need for continuous monitoring and vulnerability assessments. -Backup Strategies: Discuss the importance of regular data backups and disaster recovery planning. **-Case Study Analysis (10 minutes)** Provide students with a brief case study of a cloud data security incident. Facilitate a discussion on the causes, impact, and lessons learned from the incident. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.

Closure	1.Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings** • "Cloud Security and Privacy" by Tim Mather, Subra Kumaraswamy, and Shahed Latif. • "The Cloud Security Ecosystem: Technical, Legal, and Compliance Issues" - Research articles discussing best practices. • YouTube Reference: Data Security in Cloud Computing https://www.youtube.com/watch?v=uu94ukZwqUI
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is data security in the context of cloud computing, and why is it crucial for organizations? 2. How do various threats and vulnerabilities impact data security in cloud environments? 3. Who are the key stakeholders in cloud data security, and what are their roles and responsibilities? .

Lesson Plan No. 4.8	Course Name: Cloud Computing and Services Topic: Legal issues in cloud computing	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define legal issues relevant to cloud computing and their implications for businesses. - Discuss key regulations and compliance requirements (e.g., GDPR, HIPAA). - Analyze the responsibilities of cloud service providers and customers in legal contexts.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	• **Introduction** (5 minutes) -Define legal issues in cloud computing and their importance. -Discuss the potential consequences of non-compliance and legal challenges faced by organizations using cloud services. -Introduce a real-world example of a legal case involving cloud computing (e.g., a data breach lawsuit or regulatory action). **2. Development** (30 minutes) **Key Concepts:** Understanding Legal Frameworks: • Overview of relevant laws and regulations (e.g., GDPR, HIPAA, CCPA). • Explain how these regulations impact cloud service providers and their customers. **Key Legal Issues in Cloud Computing:** • **Data Privacy:** Discuss issues related to personal data storage, processing, and transfer. • **Intellectual Property:** Explore challenges regarding ownership and licensing of data and applications in the cloud. • **Compliance and Accountability:** Discuss the shared responsibility model and how it relates to legal compliance. **Case Study Analysis (10 minutes)** • Provide students with a brief case study of a legal issue in cloud computing (e.g., a lawsuit related to data breach or non-compliance). • Facilitate a discussion on the legal implications, outcomes, and lessons learned from the case.

	3. Exercise (5 minutes) – - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **References:** - "Cloud Computing Law" by Chris Reed and John Decker - "The Legal and Regulatory Environment of Cloud Computing" - Research articles discussing compliance issues. - https://www.youtube.com/watch?v=ZAC0yO2XudU
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions**: 1. What are the primary legal issues organizations face when using cloud computing, and why are they important? 2. How do regulations like GDPR and HIPAA affect cloud service providers and their customers? 3. Who are the key stakeholders in cloud computing legal issues, and what are their responsibilities?

Lesson Plan No. 5.1	Course Name: Cloud Computing and Services Topic: Introduction to AWS Architecture	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define AWS architecture and its key components. - Understand the significance of cloud computing and AWS in modern IT infrastructure. - Identify the basic services offered by AWS and their use cases.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Briefly define AWS (Amazon Web Services) and its role in cloud computing. -Discuss the importance of cloud architecture in today's digital landscape. -Mention a real-world example of a company leveraging AWS (e.g., Netflix for streaming services). **2. Development** (30 minutes) - **Definition and Key Concepts:** • Define AWS architecture and its unique features compared to traditional IT infrastructure. • Explain concepts like scalability, elasticity, and on-demand resources. - **Basic Components of AWS Architecture:** • Describe the key services, including: **-EC2 (Elastic Compute Cloud):** Virtual servers for running applications. **-S3 (Simple Storage Service):** Scalable storage for data. **-RDS (Relational Database Service):** Managed database services. **-VPC (Virtual Private Cloud):** Isolated cloud resources. • Highlight the importance of security features like IAM (Identity and Access Management). - **Benefits of AWS Architecture:** • Discuss cost-effectiveness, scalability, and high availability. • Provide examples of AWS applications in various sectors like e-commerce, healthcare, and gaming. - **Challenges in AWS Architecture:** • Address concerns such as vendor lock-in, data security, and management complexity.

	3. Activity (10 minutes) Divide students into small groups and ask them to brainstorm applications of federated learning in various fields. Each group will share their ideas with the class. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. . Spend 5 minutes to wrap up and consolidate the learnings **References:** -AWS Documentation: aws.amazon.com/documentation -YouTube Videos: -"AWS in 10 Minutes" - An overview of AWS services. - "AWS Architecture Overview" - A detailed explanation of AWS architecture components. -"Introduction to AWS for Beginners" - A beginner-friendly introduction to AWS services.
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. Reflective Questions: 1. What is AWS architecture, and how does it differ from traditional IT infrastructure? 2. Name one key benefit and one challenge of using AWS. 3. In what ways can AWS improve business operations in different sectors?

Lesson Plan No. 5.2	Course Name: Cloud Computing and Services Topic: Designing Scalable Applications	Course No.: COM-701

Objectives	At the end of the lesson the student shall be able to: - Define scalability and its importance in modern application development. - Discuss the difference between vertical and horizontal scaling. - Mention a real-world example of a scalable application (e.g., Amazon, Netflix).
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Define scalability and its importance in modern application development. -Discuss the difference between vertical and horizontal scaling. -Mention a real-world example of a scalable application (e.g., Amazon, Netflix). **2. Development** (30 minutes) **Key Concepts of Scalability:** • Explain the concepts of load balancing, redundancy, and fault tolerance. • Discuss how scalability affects performance, user experience, and cost. **Principles of Designing Scalable Applications:** • **Decoupling:** Explain the importance of microservices and service-oriented architecture. • **Statelessness:** Discuss the benefits of stateless application design. • **Data Management:** Explore database scalability techniques (sharding, replication). • **Caching Strategies:** Explain how caching can improve performance and reduce load. **Scalable Architecture Patterns:** • **Microservices Architecture:** Advantages and challenges. • **Serverless Architecture:** How serverless computing aids scalability. • **Event-Driven Architecture:** Benefits of asynchronous processing. **Real-World Applications and Case Studies:** • Analyze the architecture of a scalable application (e.g., Twitter's use of microservices). • Discuss the scalability challenges faced by companies and how they overcame them. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.

Closure	• Summarize the Lesson Learning Outcomes and get affirmation from Students on these. • Spend 5 minutes to wrap up and consolidate the learnings. **Suggested Readings:** Articles and whitepapers on scalable application design (e.g., Martin Fowler's writings on microservices). YouTube Videos: • "Scaling Applications: A Practical Approach" • "Microservices Architecture Explained" • "Serverless Architecture: The Future of Cloud Computing"
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What does scalability mean in the context of application design? 2. Name one key principle for designing scalable applications. 3. How can caching improve the scalability of an application?

Lesson Plan No. 5.3	Course Name: Cloud Computing and Services Topic: High Availability and Fault Tolerance	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define high availability (HA) and fault tolerance (FT) and explain their importance in system design. - Identify the key strategies and components used to achieve HA and FT. - Analyze real-world examples of HA and FT implementations.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Define high availability and fault tolerance. -Discuss why these concepts are critical for modern applications (e.g., reducing downtime, ensuring reliability). -Provide a real-world example of a highly available system (e.g., Google Cloud, AWS). **2. Development** (30 minutes) **Key Concepts:** • Explain the difference between high availability and fault tolerance. • Discuss SLAs (Service Level Agreements) and their relevance to HA and FT. **Strategies for Achieving High Availability:** • **Redundancy:** Describe active-active vs. active-passive configurations. • **Load Balancing:** Explain how load balancers distribute traffic across multiple servers. • **Geographic Distribution:** Discuss the benefits of deploying services across multiple regions or availability zones. **Strategies for Achieving Fault Tolerance:** • **Replication:** Explain data replication and its role in fault tolerance. • **Graceful Degradation:** Discuss how systems can maintain limited functionality in the event of a failure. • **Automated Recovery:** Explain the importance of automated failover mechanisms and monitoring. **Real-World Examples:** • Analyze a case study of a company that successfully implemented HA and FT (e.g., Netflix's use of chaos engineering). • Discuss lessons learned from failures in systems that lacked HA and FT. **3. Exercise (5 minutes)** - Ask students to share their thoughts on what makes a good SLA and discuss examples from their experiences.

Closure	• Summarize the Lesson Learning Outcomes and get affirmation from Students on these. • Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings:** Articles and whitepapers on high availability and fault tolerance best practices. YouTube Videos: • "High Availability Explained" • "Fault Tolerance: What You Need to Know" • "Chaos Engineering: A Guide to Building Resilient Systems"
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What are the main differences between high availability and fault tolerance? 2. Name one strategy for achieving high availability and explain its importance. 3. How can automated recovery mechanisms improve fault tolerance in a system?

Lesson Plan No. 5.4	Course Name: Cloud Computing and Services Topic: Introduction to Content Delivery Networks (CDNs)	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: -Define Content Delivery Networks (CDNs) and explain their importance in modern web architecture. -Discuss common challenges associated with CDNs and strategies to mitigate them.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Define CDNs: Introduce the concept of Content Delivery Networks and their role in delivering content efficiently to users. -Importance of CDNs: Discuss how CDNs enhance website performance, reduce latency, and improve user experience. -Real-World Example: Share a case study of a popular website or application that benefits from CDN usage (e.g., Netflix, Amazon). **2. Development** (30 minutes) **Overview of How CDNs Work:** • Explain the architecture of CDNs, including edge servers and origin servers. • Discuss how caching and content replication work to reduce load times. C**ommon Security Challenges:** • Discuss security risks associated with using CDNs (e.g., DDoS attacks, data breaches). • Highlight strategies to mitigate these challenges (e.g., using HTTPS, DDoS protection measures). **Performance Challenges:** • Address potential issues like cache misses and the importance of optimizing cache strategies. • Discuss managing expectations between CDN providers and users regarding performance metrics. **3. Exercise (5 minutes) –** - Engage students in a discussion about their experiences with CDNs.

Closure	**Summary:** Recap the key points discussed in the lesson regarding CDNs, their importance, and associated challenges. Q&A Session: Conduct a quick Q&A to reinforce understanding and clarify any doubts. **Suggested Readings:** • "Content Delivery Networks: Principles and Practice" by Tarek S. Sobh • Online resources from CDN providers like Cloudflare, Akamai, and AWS.
Evaluation	1. Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is a CDN, and why is it essential for modern web applications? 2. Name one key benefit of using a CDN for a website. 3. What challenges might organizations face when using CDNs, and how can they mitigate these issues?

Lesson Plan No. 5.5	Course Name: Cloud Computing and Services Topic: Setting Up Amazon CloudFront	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define Amazon CloudFront and its significance in content delivery. - Understand the basic components and architecture of CloudFront. - Demonstrate the steps to set up Amazon CloudFront for web applications.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) **Definition of Amazon CloudFront:** -Explain what Amazon CloudFront is: a content delivery network (CDN) service that accelerates the delivery of websites, APIs, and other content. **Importance of CloudFront:** -Discuss the significance of CDNs in improving load times, enhancing user experience, and reducing latency. **Real-World Example:** Introduce a scenario where a website uses CloudFront to deliver content globally (e.g., a media streaming site). **2. Development** (30 minutes) **-Key Concepts** • **Understanding CDNs:** Explain how CDNs work to cache content closer to users and reduce the load on the origin server. • **CloudFront vs. Traditional Content Delivery:** Highlight the differences in performance, scalability, and global reach. **Architecture of Amazon CloudFront** • **Fundamental Components:** **Distribution:** Explain what a distribution is and how it connects to origin servers. **Edge Locations:** Discuss the role of edge locations in caching content. **Origin Servers:** Define origin servers and how they serve the original content. **Setting Up Amazon CloudFront** • **Step-by-Step Process:** 1. **Create a CloudFront Distribution:** ▪ Demonstrate how to create a new distribution in the AWS Management Console. 2. **Configure Origin Settings:** ▪ Show how to specify the origin server (e.g., S3 bucket

	or HTTP server). 3. **Set Cache Behavior:** ▪ Discuss how to set cache settings, including TTL (Time to Live). 4. **Configure SSL and Security Settings:** ▪ Explain how to enable HTTPS and set security policies. 5. **Deploy and Test:** ▪ Guide students on how to deploy the distribution and test its performance. **Benefits of Using CloudFront** • **Advantages:** Faster content delivery, scalability, reduced latency, and enhanced security features. **3.Exercise (5 minutes)** -Ask students to think of potential applications of CloudFront in different industries (e.g., e-commerce, gaming, education) and share their thoughts.
Closure	**Summary of Learning Outcomes:** Review key concepts discussed and confirm understanding. **Wrap Up:** Encourage students to explore AWS documentation and practice setting up CloudFront in their own AWS accounts. **Suggested Readings:** • AWS Documentation: Amazon CloudFront Documentation • Books: "AWS Certified Solutions Architect Official Study Guide" – for further learning on AWS services. **YouTube References:** 1. AWS CloudFront Tutorial**:** AWS CloudFront Basics 2. Setting Up CloudFront: How to Set Up Amazon CloudFront 3. Understanding CDNs: Content Delivery Networks Explained
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What is Amazon CloudFront, and why is it significant for web applications? 2. Describe one key component of the CloudFront architecture. **3.** How does using CloudFront improve the performance of a website?

Lesson Plan No. 5.6	Course Name: Cloud Computing and Services Topic: Security Best Practices	Course No.: COM -701
Objectives	At the end of the lesson the student shall be able to: - Define security best practices in the context of cloud computing. - Understand the significance of security measures for protecting data and resources in the cloud. - Identify common security risks and mitigation strategies in cloud environments.	
Teaching Aids (if any)	1. Power Point Presentation 2. Youtube Videos	
Teaching Development	- **Introduction** (5 minutes) -Definition of Security Best Practices: Explain what security best practices are and their importance in cloud computing. **Relevance to Cloud Environments:** -Discuss the unique security challenges posed by cloud computing, including shared resources and data privacy. **Real-World Example:** Introduce a case study on a security breach in a cloud service provider (e.g., the Capital One breach) to illustrate the impact of poor security practices. **2. Development** (30 minutes) **Key Concepts** • Understanding Security Risks: -Identify common security risks in cloud computing, such as data breaches, account hijacking, and insecure APIs. • Importance of Security Best Practices: -Discuss the significance of adopting best practices for protecting sensitive data and ensuring compliance with regulations (e.g., GDPR, HIPAA). **Security Best Practices** • **Access Control:** -Explain the importance of least privilege access and role-based access control (RBAC). • **Data Encryption:** -Discuss the necessity of encrypting data at rest and in transit. • **Regular Audits and Monitoring:** -Highlight the need for continuous monitoring and regular security audits to identify vulnerabilities. • **Incident Response Plan:** -Describe the importance of having an incident response plan in place to address potential security incidents quickly. • **Training and Awareness:** Emphasize the role of employee training in recognizing phishing attempts and following security protocols. **Tools and Frameworks** • **Security Tools:**	

	○ **Introduce tools for cloud security, such as:** ▪ AWS CloudTrail for monitoring account activity. ▪ Azure Security Center for threat protection. ▪ Cloud Security Posture Management (CSPM) tools.
	3. Exercise (5 minutes • **Engagement Activity:** ○ Ask students to discuss the security measures their organizations currently implement and share ideas for improvement. **Key Concepts** • **Understanding Security Risks:** ○ Identify common security risks in cloud computing, such as data breaches, account hijacking, and insecure APIs. • **Importance of Security Best Practices:** ○ Discuss the significance of adopting best practices for protecting sensitive data and ensuring compliance with regulations (e.g., GDPR, HIPAA). **Security Best Practices** • **Access Control:** ○ Explain the importance of least privilege access and role-based access control (RBAC). • **Data Encryption:** ○ Discuss the necessity of encrypting data at rest and in transit. • **Regular Audits and Monitoring:** ○ Highlight the need for continuous monitoring and regular security audits to identify vulnerabilities. • **Incident Response Plan:** ○ Describe the importance of having an incident response plan in place to address potential security incidents quickly. • **Training and Awareness:** ○ Emphasize the role of employee training in recognizing phishing attempts and following security protocols. **Tools and Frameworks** • **Security Tools:** ○ Introduce tools for cloud security, such as: ▪ AWS CloudTrail for monitoring account activity. ▪ Azure Security Center for threat protection. ▪ Cloud Security Posture Management (CSPM) tools.
	3. Exercise (5 minutes) • **Engagement Activity:** ○ Ask students to discuss the security measures their organizations currently implement and share ideas for improvement. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings. **Suggested Readings:** • " "Cloud Security Best Practices" - A comprehensive guide outlining essential security strategies and practices for cloud environments. • "The Cloud Security Ecosystem: Technical, Legal, and Compliance Considerations" - An exploration of the security landscape in cloud computing, including compliance issues. • "Cloud Computing Security Issues and Challenges: A Survey" - A research paper that identifies key security challenges and proposed solutions in cloud computing.
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:**? 1. What is data security in the context of cloud computing, and why is it crucial for organizations? 2. How do various threats and vulnerabilities impact data security in cloud environments? 3. Who are the key stakeholders in cloud data security, and what are their roles and responsibilities?

Lesson Plan No. 5.7	Course Name: Cloud Computing and Services Topic: Building Content Delivery Networks (CDN) Using Clouds	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define the concept of a Content Delivery Network (CDN) and its architecture. - Identify key cloud providers and services for building a CDN. - Implement a CDN using a chosen cloud service provider. - Evaluate the performance and scalability benefits of using CDNs in cloud environments.
Teaching Aids (if any)	3. Power Point Presentation 4. Youtube Videos
Teaching Development	**1. Introduction** (5 minutes) -Briefly recap what a CDN is and its importance in content delivery. -State the goal of the lesson: to learn how to build and deploy a CDN using cloud services. **2. Development** (30 minutes) • **Overview of CDN Architecture:** o Describe the architecture of a CDN, including edge servers, origin servers, and caching strategies. o Discuss the concept of geographic distribution and how it reduces latency. • **Choosing a Cloud Provider for CDN:** o Compare CDN offerings from popular cloud providers like AWS (CloudFront), Azure (CDN), and Google Cloud (Cloud CDN). o Discuss the factors to consider when selecting a CDN service (e.g., pricing, geographic coverage, integration with existing services). • **Building a CDN Using Cloud Services:** o **Step-by-Step Implementation:** ▪ Guide students through the process of creating a CDN using a selected cloud provider (e.g., setting up a CloudFront distribution in AWS). ▪ Demonstrate key configurations such as: ▪ Specifying the origin server ▪ Setting caching rules ▪ Enabling HTTPS and security settings ▪ Configuring custom domains • **Testing and Monitoring:** o Discuss how to test the performance of the CDN after deployment. o Introduce monitoring tools available in cloud platforms to track CDN performance (e.g., AWS CloudWatch, Azure

	Monitor). **3. Case Study Analysis (10 minutes)** • Present a real-world case study of an organization that successfully built and leveraged a CDN using cloud services (e.g., how a streaming service optimized content delivery). • Facilitate a discussion on the lessons learned and the impact on performance and user experience. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1.Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings** • "Building Content Delivery Networks" - A comprehensive guide covering the architecture and implementation of CDNs using cloud services. • "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl - Sections related to content delivery and cloud architecture. • YouTube Reference: How to Build a CDN in the Cloud
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions:** 1. What are the critical steps in building a CDN using cloud services, and why are they important? 2. How does using a CDN impact the performance and scalability of applications? 3. Who are the stakeholders involved in building and maintaining a CDN, and what roles do they play?

Lesson Plan No. 5.8	Course Name: Cloud Computing and Services Topic: Introduction To Cloud Mashups	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Define cloud mashups and understand their significance in cloud computing. - Identify different types of mashups and their applications. - Analyze the components and technologies used in building cloud mashups. - Explore real-world examples of cloud mashups and discuss their impact on business and user experience.
Teaching Aids (if any)	1. Power Point Presentation 2. Online contents 3. Youtube Videos
Teaching Development	• **Introduction** (5 minutes) -Define cloud mashups and explain how they combine data, services, and applications from different sources. -Discuss the relevance of mashups in today's cloud-centric environment, emphasizing their role in enhancing productivity and user engagement. **2. Development** (30 minutes) • **Understanding Cloud Mashups:** o Explain the concept of mashups in general and how they differ from traditional applications. o Discuss the architecture of cloud mashups, including APIs, data sources, and user interfaces. • **Types of Cloud Mashups:** o **Data Mashups:** ▪ Combine data from multiple sources to create new insights (e.g., Google Maps with live traffic data). o **API Mashups:** ▪ Integrate functionalities from different APIs to enhance applications (e.g., a weather application that uses APIs from various weather services). o **Service Mashups:** ▪ Combine multiple services to create a new service (e.g., an e-commerce site that integrates payment gateways and shipping services). • **Building Cloud Mashups:** o Discuss the technologies and tools used for creating mashups, such as JavaScript, HTML5, and APIs (RESTful, SOAP). o Introduce platforms that facilitate mashup creation, like Zapier and IFTTT. **3. Case Study Analysis (10 minutes)**

	• Present a case study of a successful cloud mashup (e.g., Airbnb's integration with Google Maps). • Facilitate a discussion on the impact of the mashup on user experience and business outcomes. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from Students on these. 2. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings:** "Cloud Mashups: Concepts and Architectures" - A guide that discusses the principles and architectures of cloud mashups. "APIs: A Strategy Guide" by Daniel Jacobson, Greg Brail, and Dan Woods - Provides insights into building and using APIs for mashups. YouTube Reference: Introduction to Cloud Mashups -
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions**: 1. What are the key components of a cloud mashup, and why are they important for its functionality? 2. How do cloud mashups enhance user experience and provide business value? 3. Who are the main stakeholders involved in creating and maintaining cloud mashups, and what roles do they play?

Lesson Plan No. 5.9	Course Name: Cloud Computing and Services Topic: Tools and platforms for building mashups	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Identify various tools and platforms available for building mashups. - Understand the features and capabilities of different mashup tools. - Evaluate the suitability of tools for specific use cases in creating mashups. - Demonstrate basic skills in using one or more mashup development platforms.
Teaching Aids (if any)	1.Power Point Presentation 2.Online contents 3.Youtube Videos 4. Hands-on Lab with selected tools 5. Case studies showcasing successful mashup implementations
Teaching Development	• **Introduction** (5 minutes) -Introduce the concept of mashups and their significance in modern applications. -State the goal of the lesson: to explore the tools and platforms that facilitate mashup development. . **Development** (30 minutes) • **Overview of Mashup Tools:** o Discuss the different categories of mashup tools, including: ▪ **Data Mashup Tools:** For combining data from multiple sources (e.g., Google Data Studio, Tableau). ▪ **API Mashup Tools:** For integrating APIs into applications (e.g., Zapier, IFTTT). ▪ **Service Mashup Tools:** For creating new services by combining existing ones (e.g., Mashup Editor, Yahoo Pipes). • **Feature Comparison of Popular Tools:** o Compare the features of various mashup tools, focusing on aspects such as: ▪ Ease of use (user interface and user experience) ▪ Supported data sources and APIs ▪ Integration capabilities ▪ Customization options and extensibility ▪ Pricing models (free vs. paid plans) • **Hands-On Activity:** o Introduce a selected mashup platform (e.g., Zapier or IFTTT) and guide students through the following: ▪ Signing up for an account ▪ Creating a simple mashup (e.g., combining Google Sheets with Slack)

	▪ Demonstrating key features like triggers and actions **3. Case Study Analysis (10 minutes)** • Present a case study of a successful mashup built using a specific tool (e.g., a marketing dashboard using Google Data Studio). • Facilitate a discussion on the impact of the mashup on business processes and decision-making. **3. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	Summarize the Lesson Learning Outcomes and get affirmation from Students on these. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings:** • Mashups: Strategies for a New IT Paradigm" - Discusses the evolution of mashups and tools available for development. • "Building Mashups with Microsoft Office and SharePoint" - Covers practical aspects of creating mashups using Microsoft tools. • YouTube Reference: Top Tools for Building Mashups
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions**: 1. What are the key features to consider when selecting a mashup tool for a specific project? 2. How do different platforms facilitate the integration of various data sources and APIs? 3. Who are the primary users of mashup tools, and what are their typical use cases?

Lesson Plan No. 5.10	Course Name: Cloud Computing and Services Topic: Implementing Resource Mashups on AWS	Course No.: COM -701

Objectives	At the end of the lesson the student shall be able to: - Understand the concept of resource mashups and their applications in cloud computing. - Identify AWS services that can be integrated to create resource mashups. - Implement a basic resource mashup using AWS services. - Evaluate the benefits and challenges of using AWS for resource mashups.
Teaching Aids (if any)	1.Power Point Presentation 2.Online contents 3.Youtube Videos 4. Hands-on Lab with selected tools 5. Case studies showcasing successful mashup implementations
Teaching Development	**1. Introduction** (5 minutes) -Define resource mashups and explain their importance in creating integrated applications. Introduce the goal of the lesson: to learn how to implement resource mashups using AWS services. **2. Development (30 minutes)** • **Overview of Resource Mashups:** o Explain what resource mashups are and how they differ from traditional applications. o Discuss various applications and use cases for resource mashups (e.g., data aggregation, web applications). • **AWS Services for Resource Mashups:** o Identify and discuss key AWS services that can be used in resource mashups, such as: ▪ **Amazon S3:** For storing data. ▪ **AWS Lambda:** For serverless compute capabilities. ▪ **Amazon API Gateway:** For creating and managing APIs. ▪ **AWS Step Functions:** For orchestrating workflows between services. ▪ **Amazon DynamoDB:** For NoSQL database needs. • **Implementing a Resource Mashup on AWS:** o **Step-by-Step Guide:** ▪ Walk students through a simple project that implements a resource mashup, such as: ▪ Creating a Lambda function that processes data stored in S3. ▪ Using API Gateway to expose the Lambda

	function as an API. ▪ Storing processed results in DynamoDB. ▪ Demonstrating the orchestration of these services using AWS Step Functions. o Encourage students to follow along in their AWS accounts, if possible. **3. Case Study Analysis (10 minutes)** • Present a case study of a successful resource mashup implemented on AWS (e.g., a data analysis platform that integrates various data sources). • Facilitate a discussion on the design choices made and the impact on performance and user experience. **4. Exercise (5 minutes) –** - Ask students about the discussed concept in the session.
Closure	Summarize the Lesson Learning Outcomes and get affirmation from Students on these. Spend 5 minutes to wrap up and consolidate the learnings **Suggested Readings:** • "AWS Cookbook: Recipes for Success" - A practical guide to implementing various AWS services. • "Serverless Architectures on AWS" by Peter Sbarski - Discusses building applications using AWS services in a serverless manner. • YouTube Reference: Implementing Resource Mashups on AWS
Evaluation	Reflective Questions (What, why, Who?). Allow students to answer. **Reflective Questions**: 1. What are the key AWS services that facilitate the creation of resource mashups, and how do they interact with each other? 2. What are the advantages of implementing resource mashups on AWS compared to traditional infrastructure? 3.Who are the stakeholders involved in developing and maintaining resource mashups, and what are their roles?