CSPE3011 CLOUD AND EDGE COMPUTING (3-0-0)

Course Objectives:

- To introduce the core concepts and architecture of cloud and edge computing.
- To understand virtualization, cloud services, and deployment models.
- To explore resource management, scheduling, and security in cloud/edge environments.
- To study edge computing paradigms for real-time applications.
- To enable students to design and simulate cloud-edge integrated applications.

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Module – I: (08 Hours)

Introduction to Cloud Computing:

Definition and Evolution of Cloud Computing, Cloud Computing Reference Models, Characteristics, Benefits, and Challenges, Service Models (IaaS, PaaS, SaaS), Deployment Models: Public, Private, Hybrid, Community Clouds.

Case Studies: AWS, Google Cloud, Microsoft Azure

Module – II: (08 Hours)

Virtualization and Resource Management:

Virtualization Concepts: VMs, Hypervisors (Type I & II), Containers vs Virtual Machines (Docker, Kubernetes), CPU, Memory, Storage Virtualization, Resource Allocation and Scheduling, Service Level Agreements (SLAs)

Module – III: (08 Hours)

Edge Computing:

Edge Computing Fundamentals, Edge Computing Architecture, Edge vs Cloud , Edge Devices and Gateways, Real-time Processing and Latency Considerations.

From Cloud to Edge computing: Waves of innovation, Edge Computing to support User Applications (5G-Slicing, self-driving cars)

Use Cases: IoT, Smart Cities, Healthcare.

Module – IV: (07 Hours)

Security, Privacy, and Data Management:

Security Threats in Cloud and Edge, Authentication and Access Control, Data Encryption and Protection, Identity and Key Management, GDPR and Regulatory Compliance in Distributed Environments, Secure Data Offloading Techniques.

Module – V: (09 Hours)

Applications, Simulation, and Tools:

Cloud-Edge Integration in Real-World Scenarios, Simulation Tools: iFogSim, CloudSim, EdgeSim, Workload Distribution and Mobility, Performance Evaluation Metrics, Mini Projects: Smart Surveillance, Vehicular Networks, Edge AI, Emerging Trends: Serverless, Green Computing, AI at Edge

Course Outcomes (COs):

1. Understand cloud and edge computing fundamentals and architecture.
2. Demonstrate working knowledge of virtualization and resource management.
3. Analyze and design applications suitable for edge/cloud environments.
4. Identify security challenges and suggest solutions in distributed computing.
5. Develop simulations or prototypes using cloud-edge frameworks.

Books:

- Rajkumar Buyya et al., Cloud Computing: Principles and Paradigms, Wiley.
- Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press.
- Amir Vahid Dastjerdi, Fog and Edge Computing: Principles and Paradigms, Wiley.