

FOG & EDGE COMPUTING

Code: CS31121CS	Course Type: Elective	Semester: I
Evolution Scheme (TA-MSE-ESE): 20-30-100	Total Marks: 150	L-T-P (Credits): 3-0-0 (3)

Pre-Requisites: Computer Networks, Cloud Computing, IoT.

Course Objective: To enable students to understand and apply fog and edge computing paradigms for efficient, secure, and low-latency IoT and real-time applications.

Course Outcomes: At the end of the course, the student will be able to

CO-1	Understand the basic requirements and challenges of fog and edge computing
CO-2	Understand the key architectures and Resource Management in fog and edge
CO-3	Demonstrate Middleware usage and Data Management in Edge-Cloud Architectures
CO-4	Apply Integrating fog, edge, and cloud infrastructures with ML Models

Course Articulation Matrix:

PO	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
CO-1	3	2	1	-	-
CO-2	3	2	1	-	1
CO-3	3	2	-	-	3
CO-4	3	2	1	1	-

1 - Slightly;

2 - Moderately;

3 – Substantially

Syllabus:

Unit-1: Introduction to Fog Computing

Relevant Technologies, Fog and Edge Computing Completing the Cloud, Hierarchy of Fog and Edge Computing, Business Models, Opportunities and Challenges. Addressing the Challenges in Federating Edge Resources - The Networking Challenge, The Management Challenge, Miscellaneous Challenges.

UNIT-2: Integrating IoT + Fog + Cloud Infrastructures

System Modeling and Research Challenges, Methodology, Integrated C2F2T Literature by Modeling Technique, Integrated C2F2T Literature by Use-Case Scenarios, Integrated C2F2T Literature by Metrics, Future Research Directions. *Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds* -5G, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog.

UNIT-3: Optimization Problems in Fog and Edge Computing

Preliminaries, The Case for Optimization in Fog Computing, Optimization Opportunities along the Fog Architecture, Optimization Opportunities along the Service Life Cycle. *Middleware for Fog and Edge Computing: Design Issues* - Need for Fog and Edge Computing Middleware, Design Goals, State-of-the-Art Middleware Infrastructures, System Model, Architecture examples, Future Research Directions.

UNIT-4: A Lightweight Container Middleware for Edge Cloud Architectures

Clusters for Lightweight Edge Clouds, Architecture Management – Storage and Orchestration, IoT Integration, Security Management for Edge Cloud Architectures. *Data Management in Fog Computing* - Fog Data Management, *Predictive Analysis to Support Fog Application Deployment* - Predictive Analysis with FogTorchII, *Using Machine Learning for Protecting the Security and Privacy of Internet of Things (IoT) Systems* – Introduction, Survey of ML Techniques for Defending IoT Devices, Machine Learning in Fog Computing.

Learning Resources:

Text Books:

1. Fog and Edge Computing, Rajkumar Buyya, Satish Narayana Srirama, Wiley Publications, 2019.
2. Internet of Things - Architectures, Protocols and Standards, Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, © 2019 John Wiley & Sons Ltd.
3. Fog/Edge Computing for Security, Privacy and Applications, Wei Change and Jie Wu, Springer, 2021.