

Course Handout

Semester: VII

Academic Year: 2019-20

Course Code: CS4132

Course Title: Fog and Edge Computing

LTPC: 3024

Programme: Bachelor of Technology

Course-in-charge: Dr. Sanjay Kumar Biswash

1. Course Description

- In this course, we will study significant tools and applications that comprise today's cloud computing platform, with a special focus on using the cloud for networks and mankind applications.
- The course content will come directly from research papers, articles, and documentation of cloud and data center, architectures, technologies and applications.
- We will work together to develop a deep understanding of this content through class presentations and discussions of this material.

2. Course Content

Unit 1: Introduction: Internet of Things (IoT) and New Computing Paradigms, Addressing the Challenges in Federating Edge Resources , Integrating IoT + Fog + Cloud Infrastructures: System Modeling and Research Challenges , Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds, Optimization, Problems in Fog and Edge Computing.

Unit 2: Management and Middlewares: A Lightweight Container Middleware, Edge Cloud Architectures, Data Management, Fog Computing Predictive Analysis to Support Fog Application, Deployment Using Machine Learning or by other techniques for Protecting the Security, Privacy of Internet of Things (IoT) Systems.

Unit 3: Applications and Issues : Fog Computing Realization for Big Data Analytics, Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing, Human Objects Tracking Fog Computing Model for Evolving Smart Transportation, Testing Perspectives of Fog-Based IoT, Legal Aspects of IoT Applications in the Fog, Modeling and Simulation of Fog and Edge Computing .

Unit 4: Research: TBD by course-in-charge.

3. Course Outcomes: After the completion of the course the student will be able to:

CO1	Describe the key architectures, working and applications in edge computing
CO2	Critically evaluate research publications on cloud services and edge computing.
CO3	Develop and deliver oral presentations for research publications on cloud and edge computing.
CO4	Implement software using standard open-source cloud and edge computing software real life issues.
CO5	Develop and execute a research project related to fog and edge computing.

4. Course Outcomes Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	H	H	M	H	H	M	H	H	H	L	L	H	L	H	H
CO2	H	H	H	H	H	M	NA	H	H	L	NA	H	H	H	H
CO3	H	L	L	M	H	NA	NA	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	M	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Note: H- High, M- Moderate, L- Low and NA- Not Applicable

5. Session Plan*

Lecture No.	Topics	Course Outcome
1-7	Introduction: Internet of Things (IoT) and New Computing Paradigms, Addressing the Challenges in Federating Edge Resources , Integrating IoT + Fog + Cloud Infrastructures.	CO1 CO2
8-14	System Modeling and Research Challenges , Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds, Optimization, Problems in Fog and Edge Computing.	CO2, CO4, CO5
15-19	Management and Middlewares: A Lightweight Container Middleware, Edge Cloud Architectures, Data Management, Fog Computing Predictive Analysis to Support Fog Application. .	CO1, CO2, CO4 CO5
20-26	Deployment Using Machine Learning or by other techniques for Protecting the Security, Privacy of Internet of Things (IoT) Systems	CO1, CO2, CO4 CO5
27-33	Applications and Issues : Fog Computing Realization for Big Data Analytics, Exploiting Fog Computing in Health Monitoring, Smart Surveillance Video Stream Processing, Human Objects Tracking.	CO1, CO2 CO4 CO5
34-39	Fog Computing Model for Evolving Smart Transportation, Testing Perspectives of Fog-Based IoT, Legal Aspects of IoT Applications in the Fog, Modeling and Simulation of Fog and Edge Computing .	CO4, CO5

40-45	Research, presentation and discussion	CO2 CO3 CO5
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6. Evaluation Scheme

Evaluation Components	Mode of Exam	Date & Day	Time	Weightage
Med Sem I	Written (Pen/Paper)	As per academic calendar	1 h	15%
Med Sem II	Written (Pen/Paper)	As per academic calendar	1 h	15%
Comprehensive/End Sem	Written (Pen/Paper)	As per academic calendar	3 h	40%
Practicals++, Research and viva voce.	Lab performance, Practical exam, research outcome and Viva	Before comprehensive exam	1 h or more	10%, 5% and 5%
Attendance		Throughout the course		As per NU policy

++Practical Exam will be evaluated based on Lab-Performance, Viva, Regularity, and practical record. Students must perform one to two practicals in the final practical exam to be conducted before the comprehensive exam. Course Practical Evaluation Scheme is as follows:

Evaluation Components	Weightage (20%)
Practical Exam	5%
Viva Voce	5%
Daily performance and Practical reports	5%
Research	5%

7. Course Outcomes Mapping with Evaluation Components

Course Outcomes	Mid-Sem I	Mid-Sem II	Comprehensive/End Sem	Practical
CO1	H	H	H	H
CO2	H	H	H	H
CO3	M	H	H	H
CO4	M	H	H	H
CO5	M	M	H	H

H- High, **M-** Moderate, **L-** Low and **NA-** Not applicable

8. Attendance Policy

As per Attendance policy of the University

9. Make up Policy

Students who are likely to miss a component of evaluation on a genuine reason may be given a make-up of that component by the Course In-Charge. The students are required to approach either of the Course In-Charge immediately for the same before the conduct of the evaluation component. It is the responsibility of the student to approach the Course In-Charge. The Course In-Charge will not allow makeup, if student approach 7 days after the Examination.

10. Plagiarism

We are committed to upholding standards of academic integrity and honesty. Plagiarism in any form is unacceptable and will be treated seriously.

11. Grading Policy

Marks obtained in all the components of Evaluation shall be totaled and the final marks shall be converted in the letter grades, namely, A, B, C, D, E and NC. The grading is relative and normally it is centered around the average of a class. Mid-semester grading will be announced after the Mid-term 2examination.

12. Pedagogy

The following modern online tools will be used for teaching and practical purpose.

MS-PowerPoint Presentations

Videos and Animation of few lectures,

Open Course Ware Websites

Online Journals from IEEE, Elsevier, Wiley etc.

13. Text Books

TB1. Fog and Edge Computing: Principles and Paradigms, Rajkumar Buyya (Editor), Satish Narayana Srirama (Editor), ISBN: 978-1-119-52498-4

14. Reference Books

RB1. Edge Computing: A Primer – 2018, Authors: Jie Cao, Quan Zhang, Weisong Shi, 978Y0Y00208Y5 (online) 978Y0Y0020828 (print)

RB2. *Fog Computing, Concepts, Frameworks and Technologies*, Editors: **Mahmood**, Zaigham, ISBN 978-Y-Y19-94890-4

15. List of Practical/Experiments Practical Session Plan*:

No	Topics	Hours	Marks
1	Architecture design for fog and edge networks	4	2
2	Performance observation and analysis of simulated architecture.	4	2
3	QoE and QoS improvement	4	2
4	UI and nodes design	4	2
5	Deployment for research	4	2
6	Output optimization	4	2
7	Research Presentation and publication	4	3
	Total	28	

* These are tentative lecture and practical session, actual value may vary depend on students-teacher's mutual understanding.

16. Consultation Hour

All information regarding course will be posted on Moodle. Students are requested to check Moodle for any updates twice a day. The student may approach the Course-In-Charge Monday - Friday (Office hours) for any clarification or removal of their difficulties.