FIRST SEMESTER 2024-2025
Course Handout (Part II)

In addition to Part-I (General handout for all courses appended to the timetable) this portion gives further specific details regarding the course:

COURSE NO	**:**	**CS G623**
COURSE TITLE	**:**	**ADVANCED OPERATING SYSTEMS**
Instructor in-charge	**:**	**Pratik Narang [pratik.narang@pilani.bits-pilani.ac.in]**

1. COURSE OBJECTIVE

To introduce the design and implementation issues of distributed operating systems

2. PRE-REQUISITES

It is assumed that the students have done a basic course on operating systems and computer networks. Also the students should have sufficient programming experience in C/C++/Java programming languages.

3. SCOPE

Distributed Operating Systems work in an environment where we have independent machines (both hardware and software) connected with each other over a network. A Distributed OS makes a Distributed System a virtual uniprocessor system. The distributed OS to be studied in this course is microkernel based. It's just that the user level processes that are separated from the kernel can run on remote machines. Also, the OS has some sort of idea what machines are hooked up, and can make decisions about where to run things based on the relative speed of the machines.

4. BOOKS

Text Book

[T1] M. Singhal & N. Shivaratri, "Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems", Tata McGraw Hill, 2015.

Reference Books

[R1] Distributed Systems Principles and Paradigms 2/E by A. S. Tanenbaum, PHI
[R2] Distributed Operating Systems – The Logical Design by A. Goscinski, AW
[R3] Distributed Systems-Concepts and Design by G. Coulouris, AW

5. PLAN OF STUDY

Lec#	Lecture Session	Learning Outcome	REFS (Text)
1-2	Overview of Advanced Operating System, Review of concepts	Design approaches, Motivation, Review, Types of Advanced OS.	T1. Ch 1, R1. Ch 1, R2. Ch 1
3-4	Architecture and Models for Communication	Architectural Issues, Communication Networks, and Communication Primitives. Need for a model, Message Passing for IPC, Shared Variables, Relationship among models	T1. Chap 4, R2. Ch 3
5-7	Time in distributed systems	Limitations of DS, logical clock, vector clock, physical clock synchronization, causal ordering of messages, global state, cuts of distributed	T1. Ch 5, R1. Ch 6, R2. 6 and 8

		computation	
8-12	Distributed Mutual Exclusion	Lamport, Recart-agrawala, and Maekawa's algorithms; Suzuki-kasami broadcast algorithm, and Raymond's tree based algorithm	T1. Ch 6, R2. Ch 7
13-15	Global State Collection and Distributed Deadlock Detection	Resource and Communication deadlock, Strategies to handle deadlock, Deadlock Detection Algorithms	T1. Ch 7, R2. Ch 9
16-20	Agreement and Consistency Protocols	System model, Classification of agreement problems, Solutions to Byzantine agreement problems, Consistency, Raft	T1. Ch 8
21-23	Coordination Algorithms	Leader Election, Bully algorithm, Election in rings, HS algorithm, Peterson algorithm	R2. Ch 11
24-27	Distributed File Systems	DFS architecture, HDFS, MapReduce	T1 Ch 9
28-32	Distributed Scheduling	Issues in Load Distribution, Components of a load distribution algorithm, Load Distribution Algorithms, Fair-share scheduling	T1. Ch 11
33-37	Fault Tolerance and recovery	Distributed Transactions, Commit Protocols, Two phase commit, Voting Protocols, Failure Resilient Processes, Classification of failures	T1. Ch 12,13, R2. Ch 12
38-40	Recent research in Distributed Systems	Recent research on consensus/agreement, leader election, blockchain, etc.	Research papers

EVALUATION SCHEME

Component	Duration	Nature	Weightage	Date and Time
Mid-Semester Test	90 Min	Closed book	25 %	3/10 AN2
Quiz(zes)	TBA	TBA	15 %	TBA
Assignment(s)	TBA	Open book	25 %	TBA
Comprehensive Exam	180 Min	Partly Open book	35 %	12/4 AN

NOTICES

All notices related to the course will be posted on Nalanda.

MAKE-UP

- **For make-up in Mid-Semester Test:** Makeups, in general, are allowed only in case of hospitalization. Prior permission of the IC is a must.
- **For make-up in Quiz and Assignment components:** no makeup will be given.
- **For comprehensive examination make-up**: contact AUGSD/AGSRD.

CHAMBER CONSULTATION HOUR: send an email to the Instructors and seek time for consultation.

Instructor-in-charge, CS G623