	School of Engineering & Technology	
	Department: SOET	**Session: 2024-2025**
	Programme: B Tech CSE/Cybersecurity/DS/AI/Ml/FSD/UI/UX	**Semester: V**
	Course Code: ENCS303	**Number of students:**
	Course Name: Operating System	**Faculty: Dr. Tanvi Chawla**

Assignment Number:3

Instructions:

- Attempt all questions.
- Keep answers concise and to the point.
- Logical reasoning and clarity will carry more weight than lengthy descriptions.
- Where applicable, show calculations or diagrams clearly.
- Academic integrity is expected; original responses will be rewarded.

Total marks:20

Short Answer type: Part A	Marks
1. Explain race conditions with a real-world example outside of computing, and show how mutual exclusion addresses it.	2
2. Compare Peterson's Solution and semaphores in terms of implementation complexity and hardware dependency.	2
3. The producer-consumer problem can be solved using either semaphores or monitors. Identify one advantage of using monitors in a multi-core system.	2
4. For the Reader-Writer problem, explain how starvation can occur and describe one method to prevent it.	2
5. In deadlock prevention, the "Hold and Wait" condition can be eliminated. Explain one practical drawback of doing so in an OS.	2
Part B: Application/Numerical Based	
6. **Banker's Algorithm Simulation**: A system has the following resources: Total instances: A = 10, B = 5, C = 7. Allocation & Max tables: (see below)	2

Process	**Allocation (A,B,C)**	**Max (A,B,C)**
P0	0, 1, 0	7, 5, 3
P1	2, 0, 0	3, 2, 2
P2	3, 0, 2	9, 0, 2
P3	2, 1, 1	4, 2, 2
P4	0, 0, 2	5, 3, 3

a) Calculate the Need matrix. b) Determine if the system is in a safe state. c) If P1 requests (1,0,2), check whether it can be granted immediately.	
7. **Dining Philosophers**: Simulate a 5-philosopher system using semaphores. Show step-by-step execution for a scenario where deadlock occurs, and then modify your semaphore solution to avoid it.	2
8. **I/O System Analysis**: An OS uses **interrupt-driven I/O** with an average interrupt handling time of **5 μs**. • Data transfer rate from a device: 500 KB/s • Data block size per interrupt: 100 bytes a) Calculate CPU time spent handling interrupts per second. b) Suggest one improvement to reduce CPU overhead while maintaining the same transfer rate.	2
9. **Case Study — Air Traffic Control System**: In an air traffic control system, multiple processes handle radar data acquisition, flight path calculation, and communication with pilots. a) Identify the most critical sections that require mutual exclusion and propose an IPC mechanism suitable for real-time response. b) If a deadlock occurs between radar data acquisition and flight path calculation processes, propose a detection and recovery strategy that ensures minimal disruption.	4

Submission Guidelines:

- Assignment must be submitted on the LMS only.
- File name format: EnrollmentNumber_Name (e.g., *22ABC1234_RahulSharma*).
- Submission deadline: Within 1 week from the date of assignment publication.
- Late submissions will not be accepted unless approved in advance.