Cluster Innovation Centre, University of Delhi, Delhi-110007

Examination : End Semester Examination – May 2022
Name of the Course : B.Tech (Information Technology and Mathematical Innovations)
Name of the Paper : Instructing computing devices: Operating Systems
Paper Code : 32861402
Semester : IV
Duration : 2 Hours and 30 Minutes
Maximum Marks : 50

Instructions:
This question paper contains six questions, out of which any four are to be attempted. Each question carries equal marks.

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1. Explain the Dual-Mode operation of an operating system. Mention the objectives and functions of Real-Time Embedded systems.

2. What is a semaphore? List the types of semaphores and Show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated.

3. Define Thread. Write the differences between user-level and kernel-level threads. Give the benefits of multithreading. What resources are used when a thread is created?

4. Draw the Gantt chart; find the average waiting time for the following algorithms: FCFS, Preemptive Priority and Non-preemptive priority

Process	Arrival Time(ms)	Burst time(ms)	Priority
P1	0	8	3
P2	2	6	1
P3	2	1	2
P4	1	9	2

5. Consider the following snapshot of a system with four processes P0, P1, P2, P3 and four resources A, B, C and D

Process	Max	Allocation	Available
	A B C D	A B C D	A B C D
P0	0 2 1 0	0 1 1 0	1 5 2 0
P1	1 6 5 2	1 2 3 1	
P2	2 3 6 6	1 3 6 5	
P3	0 6 5 2	0 6 3 2	

Using Banker's algorithm, answer the following questions: How many instances of resources A, B, C, D are there? What is the content of Need matrix? Is the system in a safe state? If it is, find the safe sequence.

6. Describe the necessary conditions to hold deadlock situation. Explain how to recover from deadlock.