

Day & Date : Saturday, 20/9/2025

Time : 03.15 pm to 05.15 pm

Max Marks : 50

- Instructions:**
- 1) All questions are compulsory.
 - 2) Figures in rounded () brackets within the question, indicate the scheme of marking for respective part of the question, whereas, figures in the first right column indicate total marks for that whole question.
 - 3) CO is the index number of the Course Outcome statement.
 - 4) The Bloom's taxonomy level (BL) for 1,2,3,4,5 and 6 is remember, understand, apply, analyze, evaluate and create respectively.
 - 5) Assume suitable data if necessary.
 - 6) Use of non-programmable calculators is allowed

- | | | Marks | BT Level | COs |
|-----------|--|-------|----------|-----|
| Q.1 A | Explain with schematic the main components of a Real-Time Operating System (RTOS) architecture (5). List and briefly describe operating system services that directly enhance user experience (5). | 10 | 2 | CO1 |
| B | Real-time tasks are normally classified into periodic, aperiodic, and sporadic real-time task. Identify some characteristics that are unique to each of the three categories of tasks (3). Give examples of tasks in practical systems which belong to each of the three categories (4) | 07 | 3 | CO1 |
| OR | | | | |
| | Explain the key difference in how deadlines are handled in hard versus soft real-time systems (4). Provide an example of each that would require a hard and soft real-time system and justify your choice (3). | 07 | 3 | CO1 |
| Q.2 A | Consider two periodic task sets A and b shown in the following two tables. Suppose three tasks T1, T2, and T3 are to be run on a uniprocessor system. Determine schedulability of these two task sets on uniprocessors under rate monotonic scheduling (5)? Use the standard criterion for determining their schedulability and worst-case completion time of the tasks (5). | 10 | 5 | CO2 |

Task Set A (All times are in milliseconds)			
Task Name	Execution Time	Period	Deadline
T1	20	100	100
T2	15	150	150
T3	40	400	400

Task Set B (All times are in milliseconds)			
Task Name	Execution Time	Period	Deadline
T1	40	100	100
T2	20	80	80
T3	50	200	200



		Marks	BT Level	COs
B	Define priority inversion in the context of real-time operating systems (2) and explain why it can be problematic (2). Analyze a scenario in which priority inversion occurs in a real-time operating system (3).	07	4	CO2
OR				
B	Explain semaphore in the context of computer science (2)? Discuss how a binary semaphore differs from a counting semaphore (3). Design a simple pseudocode algorithm using semaphores to prevent race conditions when multiple threads access a shared resource (2).	07	6	CO2
Q.3 A	Explain memory fragmentation in the context of a Real-Time Operating System (RTOS) (2)? Compare and contrast internal and external memory fragmentation, providing an example of each (3). Justify a strategy to minimize memory fragmentation in an RTOS-based embedded systems (3).	08	3	CO3
B	Classify events in the context of a Real-Time Operating System (RTOS) and explain its typical role in task management (4). Compare and contrast exception handling and interrupt handling in computer systems (4)	08	5	CO3
OR				
B	Write short note on purpose of timers in a Real-Time Operating System (RTOS)	08	2	CO3

