

Registration No:

--	--	--	--	--	--	--	--	--	--

al Number of Pages: 02

Course: B.Tech
Sub_Code: RCS6D001

6th Semester Regular/Back Examination: 2023-24

Real-Time System
BRANCH(S): CSE, IT
Time: 3 Hour
Max Marks: 100
Q.Code: P451

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.

The figures in the right hand margin indicate marks.

Part-I

(2 × 10)

Answer the following questions:

- Name any two important sensor devices and actuator devices used in real-time applications.
- What are the shortcomings of Windows NT?
- Discuss the schedulability criterion for RMA scheduling algorithm.
- Define byzantine clock. Explain with an example.
- What is a watchdog timer?
- Distinguish between response time and execution time of a real-time task.
- In a real-time system differentiate between performance constraint and behavioral constraint.
- What is the difference between CBR, VBR, and sporadic traffic type?
- What do you understand by an optimal scheduling algorithm? Is it true that the time complexity of an optimal scheduling algorithm for scheduling a set of real-time tasks in a uniprocessor is prohibitively expensive to be of any practical use? Explain your answer.
- Differentiate between synchronous and asynchronous I/O.

Part-II

(6 × 8)

Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)

- Explain how a real-time operating system differs from a traditional operating system. Name a few real-time operating systems that are commercially available.
- Define "Fail-safe" state of a system. Justify your answer "safety-critical real-time systems do not have a fail-safe state".
- Identify the key differences between hard, soft, and firm real-time systems. Give at least one example of real-time tasks corresponding to these three categories.
- Would it be advisable to use an Ethernet LAN in a hard real-time application such as factory automation? Justify your answer. Evaluate the pros and cons of using an Ethernet-based protocol in such an application.

- e) What is QoS routing? Briefly explain the different types of QoS routing algorithms used.
- f) Explain chain blocking. Can a task undergo Chain Blocking in Highest Locker Protocol (HLP)?
- g) Describe the focused addressing and bidding and buddy algorithm for running a set of real-time tasks in a distributed environment.
- h) Consider a calendar-based reservation protocol to transmit real-time messages over a collision-based network. Explain how transmission of asynchronous messages by nodes can be handled. Note that asynchronous messages have probabilistic arrival times and do not have any specified time bounds.
- i) What is a safety-critical system? Give a few practical examples of safety critical hard real-time systems. Are all hard real-time systems safety-critical? If not, give at least one example of a hard real-time system that is not safety critical.
- j) List the key differences between real-time databases with a traditional database.
- k) Briefly indicate how Unix dynamically recomputes task priority values. Why is such recomputation of task priorities required? What are the implications of such priority recomputations on real-time application development?
- l) Explain why 2PL-WP protocol is not free from deadlocks.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

- Q3 a) Explain the operation of priority ceiling protocol (PCP) in sharing critical resources among real-time tasks. Explain how PCP is able to avoid deadlock and chain blockings.
- b) What is DDC? What are the advantages of DDC over analog control? Discuss PID control algorithm.
- Q4 a) What do you understand by "scheduling point of a task" in scheduling algorithm? How the scheduling points are determined in clock driven, event-driven, and hybrid schedulers?
- b) Three hard real-time periodic tasks such as $T1 = (50\text{ms}, 100\text{ms}, 100\text{ms})$, $T2 = (70\text{ms}, 200\text{ms}, 200\text{ms})$ and $T3 = (60\text{ms}, 400\text{ms}, 400\text{ms})$ are to be scheduled on a uniprocessor using RMA. Can the task set be feasibly scheduled? (Show all the intermediate calculations.)
- Q5 a) What do you mean by priority inversion? Distinguish bounded from unbounded priority inversion. Demonstrate with a neat diagram.
- b) Briefly explain the highest locker protocol scheme for avoiding priority inversion.
- Q6 a) Why is it necessary to synchronize the clocks in a distributed real-time system? Discuss the relative advantages and disadvantages of the centralized and distributed clock synchronization schemes.
- b) Explain why traffic gets distorted in a multi segment network and how traffic reshaping is achieved for providing QoS guarantee.