Reg. No.



(A constituent unit of MAHE, Manipal)

Time: 3 Hours

Check

## VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING) MAKEUP EXAMINATIONS, JANUARY 2023

## **REAL TIME SYSTEMS [ELE 4064]**

**REVISED CREDIT SYSTEM** 

Date: 07 JAN 2023

Instructio	nstructions to Candidates:							
*	Answer <b>ALL</b> the questions.							
*	Missing data may be suitably assumed.							
1A.	Distinguish the timing constraints and develop three separate Finite State Machine model of a telephone system whose partial behaviour is described as:							
	"After lifting the receiver handset, the dial tone should appear within 3 seconds. If a dial tone cannot be given within 3 seconds, then an idle tone is produced. After the dial tone appears, the first digit should be dialed within 30 seconds and the subsequent five digits within 5 seconds of each other. If the dialing of any of the digit is delayed, then an idle							

**1B.** A real-time pre-emptive Rate Monotonic Scheduler (RMA) is used to schedule the periodic task set shown in the below table with the restrictions throughout its operation as: uniprocessor, period and deadline are relative to arrival time. If priorities of tasks are equal assume a secondary rule of considering the task with lower index as the highest priority.

tone is produced. The idle tone continues until the receiver handset is replaced."

Tasks	Arrival	Period	Execution	Deadline
	(ms)	(ms)	(ms)	(ms)
T1	25	30	10	20
T2	40	40	7	40
T3	60	60	10	50
T4	20	150	25	100

feasibility of the task set using analytical calculations for time demand analysis and verify the same with graphical method.

- **1C.** While using a cyclic scheduler to schedule a set of real time tasks on a processor, what are the constraints that should be satisfied to select an appropriate frame size?
- **2A.** Consider a real time system with pre-emptive periodic task set (T) shown in the below table.

		Т	Period	Execution	Deadline		
			(ms)	(ms)	(ms)		
		T1	50	10	35		
	Schedule and	T2	100	15	20	verify the	
	feasibility of the	T3	200	20	200	task set using Rate	
	Monotonic (RM)			•	•	and Deadline	(02)
	Monotonic (DM) sch	eduler	s on the tin	neline.			(03)
2B.	A real time system w	ith inc	lependent a	nd preemptive	task set is sh	own below.	(03)

(04)

the

Max. Marks: 50

(04)

(02)

Т	Release	Period	Execution	Deadline	
	(ms)	(ms)	(ms)	(ms)	
T1	0	2	0.4	2	
T2	1	4	1	4	
T3	0	5	1.5	5	

- Verify whether the task set can be scheduled using EDF? Explain your (i) answer.
- If the parameters of the system are changed, such that T3 has release time of (ii) Oms, period of 8ms, execution time of 4ms and deadline of 8ms. Can the new system task set be scheduled using EDF? Explain your answer
- A real time system is operating with 2 tasks and deferrable server (DS) as shown in the 2C. below table.

Task	Phase	Period	Execution	Deadline
		(ms)	(ms)	(ms)
T1	2	3.5	1.5	3.5
T2	0	6.5	0.5	6.5
DS	0	3	1	-

An aperiodic task of execution time of 1.7ms arrives at a time t=2.8ms. Schedule the given system using Rate Monotonic scheduler and calculate the response time for the aperiodic task. Draw the time-line for task scheduling and the server budget consumption graph. Assume deadline and period are relative to the phase.

3A. A real time system is having a pre-emptive Latest release time scheduler. The task set and the precedence graph are shown in the below table and figure respectively. Schedule the task set and explain each scheduling step. Show the timeline for the time interval [0-8] ms and check whether all the tasks meet their deadlines.

Task	Release	Execution	Deadline		
	(ms)	(ms)	(ms)		
T1	2	2	7		
T2	0	3	6		
T3	5	2	8		



(03)

(04)

A system has 4 tasks: T1, T2, T3 and T4. 2 critical resources are shared: CR1 and CR2. 3B. The priority values of each task have been shown in the below figure. larger priority values indicate higher priority. The resource requirements of these tasks and the duration for which the tasks need the three resources are also shown in figure. Compute the different types of inversions that each task might have to undergo for the given task set.



3C. Illustrate with an example and pseudocode the working of Priority inheritance protocol (PIP).

- **4A.** Explain the types of priority inversions in the Priority Ceiling Protocol (PCP). What are the advantages of PCP over other priority protocols.
- **4B.** The specifications of set of 10 periodic real-time tasks is shown in the below table. Assume that the task set need to run on a multi-processor with four processors and each processor are to be scheduled using RM algorithm. Describe the working of next-fit algorithm and allocate the tasks to the processor using next-fit algorithm.

Task	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Execution(ms)	5	5	3	1	8	11	1	3	9	17
Period(ms)	10	22	22	24	30	40	50	55	70	75

- **4C.** Explain the working of global priority protocol used for real-time communication in LAN.
- **5A.** Explain the working of focused addressing and bidding algorithm for task assignment in a multi-processor real-time system. Also illustrate how their shortcomings are overcome with the help of buddy set algorithm.
- 5B. A network designed using IEEE802.4 protocol has three nodes: Node 1 needs to transmit 2 MB of data every 600 msec. Node 2 needs to transmit 2.4 MB of data every 1000 msec. Node 3 needs to transmit 4 MB of data every 400 msec. Select a suitable Target token rotation time (TTRT) for the network and verify the token holding time for each node.
- **5C.** Justify with proper explanation and example on the requirements for an operating system to be called as a real time operating system.

(04)

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