ANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER DEGREE EXAMINATIONS, DECEMBER - 2019

SUBJECT: REAL TIME EMBEDDED SYSTEMS [ICE 4003]

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates : Answer ALL questions and missing data may be suitably assumed.

- 1A. What are the characteristics of real time systems?
- 1B. Classify the timing constraints of real time systems.
- 1C. Consider 7 processes P₁, P₂, P₃, P₄, P₅, P₆ and P₇ arriving in ready queue at time 0, 1, 2, 3, 4, 5 and 6 with priority 2, 4, 6, 10, 8, 12 and 9 respectively. If the burst time requirements are 4, 2, 3, 5, 1, 4 and 6 respectively, use preemptive priority scheduling method to find the average waiting time, average turn around time and response time. Assume higher values indicate higher priorities.

(3+3+4)

- 2A. Explain cyclic scheduler with relevant figures. List the constraints for selecting the frame size.
- 2B. Consider the following set of 3 periodic real time tasks $T_1 = (e_1 = 10ms, p_1 = 20ms)$, $T_2 = (e_2 = 15ms, p_2 = 60ms)$, $T_3 = (e_3 = 20ms, p_3 = 120ms)$ to be run on a processor. Determine whether the given task set is schedulable under Rate Monotonic Algorithm (RMA)
- 2C. Compute the different types of inversions that each task might have to undergo for the given below task graph. Task T_1 has highest priority and task T_6 has least priority.



(5+2+3)

- 3A. Explain Priority Inheritance Protocol with suitable examples. Mention the drawbacks of the same.
- 3B. A distributed system has 12 clocks. The clocks are required to be synchronized within 1 ms of each other. Assume at best 2 clocks in the system are Byzantine. Maximum drift rate of the clocks is 6 x

 10^{-6} . Determine (a) the rate at which the clocks need to exchange time values (b) the total number of message exchanges required per hour for synchronization.

3C. Define fault latency and error latency.

(4+4+2)

- 4A. Compare bus based architecture and ring architecture for real time communication in LAN.
- 4B. Suppose a network designed using IEEE 802.4 protocol has three nodes. Node N_1 needs to transmit 1MB of data every 300ms. Node N_2 needs to transmit 1.2MB of data every 500ms. Node N_3 needs to transmit 1.2MB of data every 500ms. Select a suitable Target Token Rotation Time (TTRT) for the network and compute the token holding time for each node.
- 4C. List the advantages of assembly language based development.

(4+4+2)

- 5A. Explain data flow graph model and control data flow graph model with examples.
- 5B. Write a short note on PSOS and VRTX operating systems.
- 5C. Define Task switching time and Interrupt latency time

(4+4+2)
