Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

VII SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, JANUARY 2018

SUBJECT: REAL TIME SYSTEMS [ELE 4004]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 02 JANUARY 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Draw a basic block diagram model for a real-time system and explain the working of each block in the model with the help of an example ***(04)***

1B. Real-time tasks are normally classified into periodic, aperiodic and sporadic tasks, identify the characteristics that are unique to each of the three categories of tasks. Give examples of tasks in practical systems which belong to each of the three categories of tasks ***(03)***

1C. Classify the real-time task scheduling algorithms based on how the scheduling points are defined. Explain each one of them. ***(03)***

2A. You are provided with the definitions (all tasks are independent and are pre-emptively scheduled on a uniprocessor system) of real-time system shown in **Table 2A**.

i. Can the tasks set be scheduled using Earliest Deadline First algorithm and Rate Monotonic algorithm? Explain your answer.

If the parameters of the system are changed, such that T3 has release time of 0ms, period of 8ms, execution time of 4ms and deadline of 8ms.

i. Can the new system task set be scheduled using Earliest Deadline First algorithm and Rate Monotonic algorithm? Explain your answer. ***(04)***

2B. Verify feasibility of a pre-emptive Rate Monotonic (RM) scheduler used for task set shown in **Table 2B** using analytical calculations for time demand analysis ***(03)***

2C. Schedule the task set given in **Table 2C** using Earliest Deadline First (EDF) scheduler for a timeline of T (0 to 10ms). Mention any one advantage and disadvantage of EDF Scheduler. ***(03)***

3A. A cyclic real-time scheduler is to be used to schedule three periodic tasks with the characteristics shown in **Table 3A**. Suggest a suitable frame size that can be used. Show all the intermediate steps in your calculations. ***(04)***

3B. Schedule in timeline and compare preemptive and non-preemptive scheduling for the following jobs to be run on a dual-processor system. The precedence graph is given in **Figure 3B**. J1 (e1=3), J2 (e2=4), J3 (e3=1), J4 (e4=2), J5 (e5=11). All the jobs are released at zero except for J2 which is released at 4ms. Assume Priority is higher for jobs with lower index. ***(03)***

3C. Explain three types of Priority Inversions in the Priority Ceiling Protocol (PCP). What are the advantages of PCP over other priority protocols? ***(03)***

4A. Design a deferrable server for the task set shown in **Table 4A.** Assume an aperiodic task with execution time 1.5ms arrives quite at random in every 8ms. Use pre-emptive RM scheduler for the system. Check for the system feasibility with server using analytical time demand approach. ***(04)***

4B. Explain the working of Utilization balancing algorithm for task assignment in a multi-processor real-time system. Give an example for working of the same. ***(03)***

4C. Write a pseudo-code to explain the working of focused addressing and bidding algorithm for distributed real-time systems. Mention the short-comings of algorithm ***(03)***

5A. Explain in detail the modifications made to RM and EDF algorithms to handle task dependencies or precedence constraints. ***(04)***

5B. What are the important requirements for an operating system to be called as real-time operating system? ***(03)***

5C. A network is designed using IEEE 802.4 protocol has three nodes. Node 1 needs to transmit 2MB of data every 600ms. Node 2 needs to transmit 2.4MB of data every 1000ms. Node 1 needs to transmit 4MB of data every 400ms. Select a suitable Target Token Rotation Time (TTRT) for the network and compute the token holding time for each node. ***(03)***

Table 2A

Task set	Release time(ms)	Period(ms)	Execution time(ms)	Dead line(ms)
T1	0	2	0.4	2
T2	1	4	1	4
T3	0	5	1.5	5

Table 2B

Task	Period(ms)	Execution(ms)	Dead line(ms)
T1	3	1	3
T2	5	2	5
T3	10	2	10

Table 2C

Task	Period(ms)	Execution(ms)
T1	2	1
T2	5	2.5

Table 3A

Task	Period(ms)	Execution(ms)	Dead line(ms)
T1	4	1	4
T2	5	2	5
T3	20	5	20

Table 4A

Task	Period(ms)	Execution(ms)	Dead line(ms)
T1	3	0.5	3
T2	20	5	20
T3	60	10	60

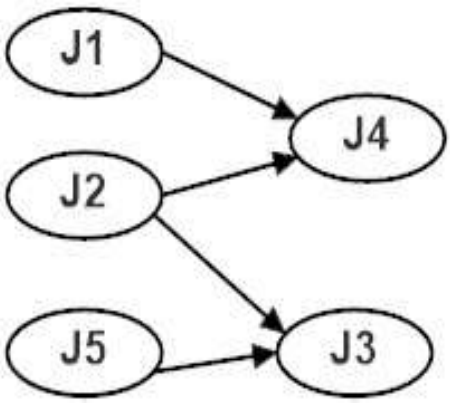

Figure 3B