Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP EXAMINATIONS, JANUARY 2019

SUBJECT: REAL TIME SYSTEMS [ELE 4004]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 02, JANUARY 2019** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions. Graph sheet can be provided
- Missing data may be suitably assumed. All values representing time is in milliseconds

1A. What is a 'real-time system'? For a suitable example, using a block diagram show the important hardware components of real-time system. Explain each block and their interactions. ***(03)***

1B. Explain the working principle of a simple priority driven preemptive scheduler used in real time systems. In a simple priority-driven preemptive scheduler, two periodic tasks T1 and T2 and a background task are scheduled. The periodic task T1 has the highest priority and executes once every 20ms and required 10ms of execution time each time. T2 requires 20ms of processing every 50ms. T3 is a background task and requires 100ms to complete. If all the tasks start at time 0, determine the time at which T3 will complete. ***(03)***

1C. A set of periodic real time task is shown in **Table 1C**, Check for feasibility of the tasks analytically if the tasks are scheduled using Rate-Monotonic (RMA) and Dead-line Monotonic (DMA). ***(04)***

2A. Check for feasibility of a pre-emptive Rate Monotonic (RM) scheduler used for task set shown in **Table 2A,** using analytical calculations for time demand analysis and verify the same with graphical method. ***(04)***

2B. Consider a preemptive Earliest Deadline First (EDF) scheduler in a real time system with 2 processors such that once a task is mapped to a processor it cannot be changed. Discuss the anomalies possible in the system with the help of relevant examples scheduled in the timeline. ***(03)***

2C. A cyclic real-time scheduler is to be used to schedule three periodic tasks with the characteristics shown in **Table 2C**. Suggest a suitable frame size that can be used. Show all the intermediate steps in your calculations. ***(03)***

3A. Explain the working principle of Least Slack Time (LST) Scheduling method for real-time tasks. Illustrate the working with help of an example by scheduling the task set on timeline. ***(04)***

3B. State the Server Budget rules for a simple deferable server based Real Time System. A real-time system runs with periodic task set and a deferable server shown in **Table 3B**, scheduled with the RMA and EDF scheduler. Schedule the task set in the timeline and draw the server budget consumption graph for a duration of 0 to 10ms for both the schedulers and compare them to select the best scheduler. Assume period and deadline are relative to phase. ***(06)***

4A. Illustrate the working of Priority Inheritance Protocol (PIP) and Highest locker Protocol (HLP) with help of suitable examples. What are the limitations of PIP and how does HLP overcome the limitations of PIP? ***(03)***

4B. Answer the following questions with respect to Priority Ceiling Protocol (PCP),

I. How is deadlock avoided in PCP?
II. How is unbounded priority inversion avoided in PCP?
III. How is inheritance related inversion limited in PCP? ***(03)***

4C. The **Table 4C** shows specifications of set of 10 periodic real-time tasks. Assume that task set need to run on a multiprocessor 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. ***(04)***

5A. 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)***

5B. Explain the working of count-down protocol used in real time communication for LAN. With the help of an example explain how high priority message is determined in Count-down protocol. ***(04)***

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

Table 1C

Task	Execution	Period	Deadline
T1	10	50	35
T2	15	100	20
T3	20	200	200

Table 2A

Task	Period	Execution	Deadline
T1	3	1	3
T2	5	1.5	5
T3	7	1.25	7

Table 2C

Task	Period	Execution	Deadline
T1	8	3	8
T2	7	2	7
T3	5	1	5

Table 3B

Task	Phase	Period	Execution
T1	2	3.5	1.5
T2	0	6.5	0.5
DS	0	3	1

Table 4C

Task	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
Execution	5	5	3	1	8	11	1	3	9	17
Period	10	22	22	24	30	40	50	55	70	75