Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

SIXTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION APRIL/MAY 2018 SUBJECT: REAL TIME SYSTEMS (ECE - 4004)

TIME: 3 HOURS

MAX. MARKS: 50

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.
- 1A. Explain the important differences between hard, soft and firm real time systems. Give example for each. List the different types of timing constraints that can occur in a real time system.
- 1B. Elaborate on typical ways to use message queue within the application with relevant diagrams.
- 1C. Define the following: i) feasible schedule ii) sporadic task iii) precedence graph iv) laxity type

(5+3+2)

- 2A. Discuss the Priority Inheritance protocol. Explain how this protocol can used to solve unbounded priority inversion with example diagrams.
- 2B. Explain the key characteristics of RTOS.
- 2C. What is starvation? Explain the 'Blocked state' of task state diagram.

(5+3+2)

- 3A. Discuss the challenges in validating timing constraints in priority driven system. Give an example to show the anomalous behaviour of priority driven system.
- 3B. Draw the task graph and also complete the table for the jobs given the timing parameter and precedence constraints. Rewrite the graph with ERT and ED

Job	Timing	Precedence	ERT	Effective	
	parameter			deadline (ED)	
\mathbf{J}_1	(0,5]	-			
J_2	(3,8]	$J_1 < J_2 < J_3$			
J ₃	(6,11]	$J_2 < J_3$			
J_4	(0,10]	-			
J ₅	(6,16]	$J2 < J_5$; $J4 < J_5$			
J ₆	(2,5]	$J_1 < J_6 < J_5$			

3C. Schedule the given four task of a system and write the timer driven scheduling table.

	T1	T2	T3	T4
Period	4	5	20	20
Execution time	1	1.8	1	2

(5+3+2)

- 4A. Give the advantages and disadvantages of EDF scheduling. Explain the Domino effect with the diagram for four tasks T1, T2, T3 and T4, with execution time equal to 2 and periods 5, 6, 7, 8 respectively.
- 4B. The feasible interval of each job in the precedence graph in Fig.4.B is given next to its name. The execution time of all jobs are equal to 1. Give a non preemptive optimal schedule that minimise the completion time of all jobs on three processors, two processors and one processor system. Describe briefly the algorithm you used to find the schedule.



4C. Write about Iterative Network Flow (INF) algorithm.

(5+3+2)

- 5A. Which of the following systems of periodic tasks are schedulable by the rate monotonic algorithm and the earliest deadline first algorithm? Explain your answer.
 - i) $T=\{(8,3),(9,3),(15,3)\}$
 - ii) $T = \{(8,4), (12,4), (20,4)\}$
 - iii) T={(8,4),(10,2),(12,3)}
- 5B. Explain the resource conflicts and blocking.
- 5C. Write the steps involved in the process of validating that a system indeed meets its real time performance objective.

(5+3+2)