

Registration No. :

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Total number of printed pages – 3

B. Tech
PECS 5403

Seventh Semester Back Examination – 2014

REAL TIME SYSTEMS

BRANCH (S) : CSE, IT

QUESTION CODE : L 160

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.*

1. Answer the following questions : 2 × 10
- What is meant by QoS routing ?
 - Why It is difficult to achieve software fault tolerance as compared to hardware fault tolerance ?
 - Identify two major shortcomings of EDF while using it in real-time task scheduling.
 - Differentiate between firm real time and hard real time system.
 - What is a clock-driven scheduler and how it is different from the event-driven scheduler ?
 - Can the following set of tasks be scheduled using EDF algorithm ? Justify your answer. $T_1 = (10, 20)$, $T_2 = (5, 25)$, $T_3 = (10, 40)$
 - Distinguish traffic shaping and policing.
 - Is it true that even in uniprocessor systems multithreading can result in faster response times compared to single-threaded tasks ?
 - Can a task undergo Chain Blocking in Highest Locker Protocol (HLP) ?
 - List the important features that are required to be supported by a RTOS.

P.T.O.

2. (a) What do you mean by Real-time system ? Using a block diagram shows the important hardware components of a real time system and interactions. Explain the roles of different components. 5
- (b) List and explain the different types of timing constraints that can occur in a real-time system. 5
3. (a) What do you mean by delay jitter in real-time communication ? Identify at least two factors which contribute to delay jitter in real-time communications and explain how they cause jitter. 5
- (b) Using a cyclic real-time scheduler, suggest a suitable frame size that can be used to schedule three periodic tasks T1, T2 and T3 with the following characteristics. 5

| Task | Phase (ms) | Execution Time (ms) | Relative Deadline (ms) | Period (ms) |
|------|------------|---------------------|------------------------|-------------|
| T1 | 0 | 20 | 100 | 100 |
| T2 | 0 | 20 | 80 | 80 |
| T3 | 0 | 30 | 150 | 150 |

4. (a) What can be the types of priority inversions that a task might undergo on account of a lower priority task under PCP ? 5
- (b) Why is it necessary to synchronize the clocks in a distributed real-time system ? Discuss the relative advantages and disadvantages of the centralized and distributed clock synchronization scheme. 5
5. (a) What do you mean by fault tolerance ? How fault are classified according to their temporal behavior and output behavior ? Discuss various types of redundancies required to design a fault tolerance system. 5
- (b) Traditional 2PL protocol is not suitable for use in real-time databases. Why ? 5
6. (a) Why is dynamically changing the priority levels of tasks important for traditional operating systems ? How does this property affect real time systems ? 5
- (b) What are the drawbacks in using Unix kernel for developing real-time applications ? 5

7. (a) What do you mean by concurrency control in a real-time database ? Explain the different categories of concurrency control protocols that can be used in real-time databases. 5
- (b) A real-time network consists of four nodes, and uses IEEE 802.4 protocol. The real-time requirement is that node N_i should be able to transmit up to b_i bits over each period of duration P_i ms, where b_i and P_i are given in the table below :

| Node | B_i | P_i |
|-------|-------|-------|
| N_1 | 1K | 10000 |
| N_2 | 4K | 50000 |
| N_3 | 16K | 90000 |
| N_4 | 16K | 90000 |

Compute a suitable TTRT and obtain suitable values of f_i (total number of bits that can be transmitted by node N_i once every cycle). Assume that the propagation time is compared to TTRT and that the system bandwidth is 1 Mbps. 5

8. Write short notes on any **two** : 5×2
- (a) Priority Inheritance Protocol (PIP)
 - (b) Real time POSIX Standard
 - (c) Real-time communication over packet switched networks
 - (d) Rate monotonic algorithm (RMA).

