Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech.**
PECS5403

7th Semester Regular / Back Examination 2017-18
Real Time Systems
BRANCH: , CSE, IT, ITE
Time: 3 Hours
Max Marks: 70
Q.CODE: B352
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) What are the different types of timing constraints that can occur in a system? Give examples of each.

b) What does the term "real" in a real-time system signify? Explain what do you mean by a real-time system.

c) Explain why safety and reliability are not independent issues in safety-critical hard real-time systems.

d) Is EDF really a dynamic priority scheduling algorithm?

e) What do you mean by jitter associated with a periodic task? How are these jitters caused?

f) Explain using an appropriate example as to why a critical resource can get corrupted if the task using it is preempted and then another task is granted use of the resource.

g) Explain some of the features that you would require a real-time operating system to support.

h) Identify at least two factors which contribute to delay jitter in real-time communications.

i) What is the difference between execution time and response time of a task? In what circumstances can they be different?

j) What is the difference between synchronous I/O and asynchronous I/O?

Q2 **a)** What is a safety-critical system? Give a few practical examples of safety-critical hard real-time systems. Are all hard real-time systems safety-critical? If not, give at least one example of a hard real-time system that is not safety-critical. **(5)**

b) What do you understand by the fail-safe state of a system? Safety-critical real-time systems do not have a fail-safe state. What is the implication of this? Explain the key differences between the characteristics of a soft real-time task and a non-real-time task. **(5)**

Q3 **a)** Prove that a set of periodic real-time tasks in RMA schedulable under any task phasing, iff all the tasks meet their respective first deadlines under zero phasing. **(5)**

b) What are the basic criteria based on which a real-time task can be determined to belong to one of the following categories: periodic, aperiodic and sporadic? Identify some 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. **(5)**

Q4 **a)** Explain the different types of priority inversions that a task might suffer due to a lower priority task when the priority ceiling protocol is used to share critical resources among a set of real-time task. Can a task suffer both inheritance-related inversion and direct inversion due to some lower priority task? If you answer in the affirmative, construct a suitable example to corroborate your answer. If you answer in the negative, explain why not. **(5)**

b) Consider a real-time system whose task characteristics and dependencies are described in the following table. Assume that the tasks have zero phasing and repeat with a period of 90 mSec. Determine a feasible schedule which could be used by a table-driven scheduler. **(5)**

Task	Computation time (e_i) mSec	Deadline (d_i) mSec	Dependency
T_1	30	90	-
T_2	15	40	T_1, T_3
T_3	20	40	T_1
T_4	10	70	T_2

Q5 **a)** When EDF is used for task scheduling in a real-time application, explain a scheme by which sharing of critical resources among tasks can be supported. Give an algorithm in pseudo-code notation to describe the steps to handle resource grant and release. **(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 schemes. **(5)**

Q6 **a)** Why is the clock resolution provided to real-time programs by different commercial real-time operating systems rarely finer than few hundreds of milliseconds though giga hertz clocks are used by these systems? Can clock resolution finer than milliseconds be provided to real-time programs at all? If yes, briefly explain how. **(5)**

b) Briefly indicate how Unix dynamically recomputes task priority values. Why is such recomputation of task priorities required? What are the implications of such priority recomputations on real-time application development? **(5)**

Q7 What do you mean by benchmarking real-time systems? Explain Rhealstone metric with following parameters: task switching time, task preemption time, interrupt latency time, semaphore shuffling time, unbounded priority inversion time and datagram throughput time. **(10)**

Q8 **Write short answer on any TWO :** **(5 x 2)**

a) POSIX

b) Real-time database

c) Highest locker protocol

d) Applications of real-time systems