Registration No : | | | | | | | | | | |

Total Number of Pages : 03 **B.Tech.**
PCS5D001

5th Semester Regular Examination 2017-18
Real Time Systems
BRANCH : CSE
Time : 3 Hours
Max Marks : 100
Q.CODE : B304

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions: *multiple type or dash fill up type*** **(2 x 10)**

a) Preemptive, priority based scheduling guarantees:
(i) hard real time functionality (ii) soft real time functionality (iii) protection of memory (iv) protection of devices.

b) Priority inversion is solved by use of _____.
(i) priority inheritance protocol (ii) two phase lock protocol (iii) time protocol (iv) all of these.

c) Type of processor in which single task of particular application is called
(i) real time processor (ii) dedicated processor (iii) applicant processor (iv) one task processor.

d) Each time a clock interrupt occurs, besides incrementing the software clock, the handler routine carries out which of the following activities?
(i) Process timer events (ii) Update ready list (iii) Update execution budget (iv) All of these

e) Which one of the following is not the deficiencies of Unix?
(i) Device driver support (ii) Real-time file service (iii) Dynamic priority recomputations (iv) Hierarchical file system

f) POSIX stands for _____.
(i) Portable Operating System Interface
(ii) Portable Operating System Input
(iii) Platform Operating System Interface
(iv) Platform Operating System Input

g) Which of the following are commercially claimed RTOSs?
(i) Linux (ii) Windows CE (iii) Windows NT (iv) SunSolaris

h) _____ traffic arises due to constant bit rate data generation.
(i) CBR (ii) VBR (iii) Sporadic (iv) All of these

i) Which of the following describes the RTOS design philosophy best?
(i) Maximize the throughput of the system
(ii) Maximize the processor utilization
(iii) Minimizing the response time
(iv) Response within certain stipulated time period

j) _____ is/are two popular dynamic real-time task allocation algorithms.
(i) Focussed addressing and bidding (ii) Buddy algorithm (iii) EDF (iv) Both (i) and (ii)

Q2 **Answer the following questions: *Short answer type*** **(2 x 10)**

a) What do you understand by the term “real-time”?

b) How jitter is associated with a periodic task?

c) Give an example of a soft real-time task and a non-real-time task.

d) What do you mean by the “fail-safe” state of a system?

e) What do you understand by an optimal scheduling algorithm? Is it true that the time complexity of an optimal scheduling algorithm for scheduling a set of real-time tasks in a uniprocessor is prohibitively expensive to be of any practical use? Explain your answer.

f) In a hard real-time system, is it necessary that every task in the system be of hard real-time type? Explain your answer using a suitable example.

g) In a real-time system what is the difference between a performance constraint and a behavioral constraint?

h) What is an open system? What are its advantages compared to a closed system?

i) Explain a real-time communication protocol that can be used in a CAN.

j) What is a watchdog timer?

Q3 **a)** What do you mean by scheduling point of a task scheduling algorithm? How are the scheduling points determined in clock-driven, event driven and hybrid schedulers? How will your definition of scheduling points for the three classes of schedulers change when (i) self-suspension of tasks and (ii) context switching overheads of tasks are taken into account. **(10)**

b) Briefly explain while scheduling a set of hard real-time periodic tasks, why RMA cannot achieve 100% processor utilization without missing task deadlines. **(5)**

Q4 **a)** Consider a real-time system which consists of three tasks T_1, T_2 and T_3 which have been characterized in the following table. **(10)**

Task	Phase mSec	Execution time mSec	Relative Deadline mSec	Period mSec
T_1	20	10	20	20
T_2	40	10	50	50
T_3	70	20	80	80

If the tasks are to be scheduled using a table-driven scheduler, what is the length of time for which the schedulers have to be stored in the precomputed schedule table of the scheduler.

b) Explain the operation of priority ceiling protocol (PCP) in sharing critical resources among real-time tasks. Explain how PCP is able to avoid deadlock and chain blockings. **(5)**

Q5 **a)** A set of hard real-time periodic tasks need to be scheduled on a uniprocessor using RMA. The following table contains the details of these periodic tasks and their use of three non-preemptable shared resources. Can the tasks T_2 and T_3 meet their respective deadlines when priority ceiling protocol is used for resource scheduling? **(10)**

Task	p_i	e_i	R1	R2	R3
T_1	400	30	15	20	-
T_2	200	25	-	20	10
T_3	300	40	-	-	-
T_4	250	35	10	10	10
T_5	450	50	-	-	5

p_i indicates the period of task T_i and e_i indicates its computation time. The period of each task is the same as its deadline. The entries in the R1, R2 and R3 columns indicate the time duration for which a task needs the named resource in non-preemptive mode. Assume that after a task releases a resource, it does not acquire the same or any other resource.

b) Explain some of the features that you would require a real-time operating system to support. **(5)**

Q6 **a)** Consider the following set of four independent real-time periodic tasks. **(10)**

Task	Start-time mSec	Processing-time mSec	Period mSec
T_1	20	25	150
T_2	40	10	50
T_3	20	15	50
T_4	60	50	200

Assume that task T_3 is more critical than task T_2. Check whether the task set can be feasibly scheduled using RMA. Justify your answer. Is RMA optimal when the task deadlines differ from the task periods?

b) What is the difference between synchronous I/O and asynchronous I/O? What are the implications of these two types of I/O for real-time applications? **(5)**

Q7 **a)** Consider a calendar-based reservation protocol to transmit real-time messages over a collision-based network: **(10)**
(i) Explain how transmission of asynchronous messages by nodes can be handled. Note that asynchronous messages have probabilistic arrival times and do not have any specified time bounds.
(ii) Explain with proper reasoning the types of traffics for which a calendar-based protocol would perform satisfactory and the types for which it will not.

b) Explain how a real-time operating system differs from a traditional operating system. Name a few real-time operating systems that are commercially available. **(5)**

Q8 **a)** Answer the following in the context of a chemical manufacturing company that wishes to automate its process control application: **(10)**
(i) What problems might arise if an attempt is made to implement the chemical plant control software using the Ethernet LAN available in the factory?
(ii) How can a global priority protocol be supported in a LAN with collision-based access?
(iii) If RMA scheduling of packets is to be supported, what is the maximum channel utilization that can be achieved?
(iv) What are the main obstacles to efficient implementation of RMA in this set up?

b) Would it be advisable to use an Ethernet LAN in a hard real-time application such as factory automation? Justify your answer. Evaluate the pros and cons of using an Ethernet-based protocol in such an application. **(5)**

Q9 **a)** What do you mean by QoS routing? Explain the different types of QoS routing algorithms. **(10)**

b) Explain why traffic gets distorted in a multisegment network and how traffic reshaping is achieved for providing QoS guarantee. **(5)**