



Student Name	
Student Section No.	

Question 1:

(8 Marks)

(a) What does **ASIC** stand for in an embedded system architecture?

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(b) Briefly describe the difference between a **critical hard-realtime** system and a **non-critical hard-realtime** system. State **one** example for **each** of them.

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(c) Draw a simple diagram that shows the behavioral specification of an **embedded system** that controls an **ATM machine** with at least **four different states**.

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(d) Write a sample **pseudocode** that implements a **power-saving super loop** for a sequence of tasks that are performed in an embedded system.

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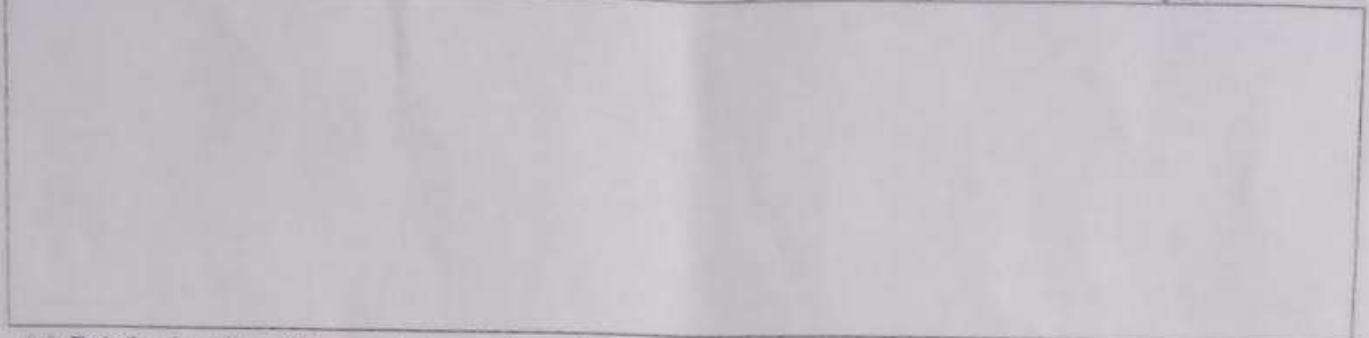
Question 2:

(12 Marks)

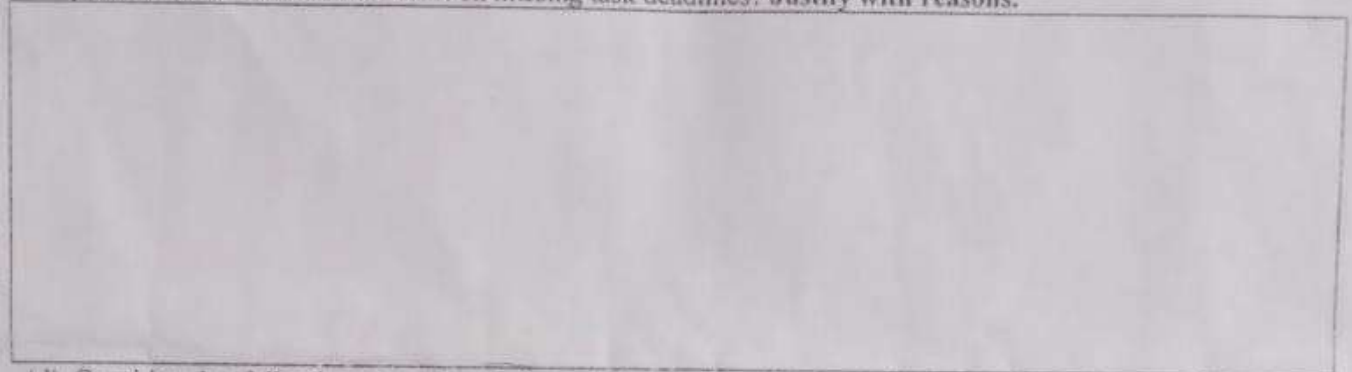
(a) Briefly describe the purpose of having a **Realtime Kernel** in building an embedded system.

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(b) Draw a diagram that shows a **hardware/software co-design methodology** for an embedded system.



(c) Briefly describe difference between the **priority inversion** problem and the **unbounded priority inversion** problem that may occur in processor scheduling of tasks in **real time embedded systems**. Which of the two problems has more critical effect on missing task deadlines? **Justify with reasons.**



(d) Consider the following set of periodic real-time tasks with the following execution profiles: **Task T1** execution time is **50 ms** and execution rate is **10 hz**, **Task T2** execution time is **100 ms** and execution rate is **8 hz** and **Task T3** execution time is **150 ms** and execution rate is **5 hz**.

- (i) Can the three tasks be successfully scheduled using **perfect scheduling**? **Why?**
- (ii) Suppose that the first instance of each of the **three** tasks arrives at time $t = 0$. Assume that the **deadline** for each task is **less than its corresponding execution period by 10%**. Draw a timing diagram that uses **rate monotonic scheduling** to show the steps of task scheduling over time. Will all the tasks' deadlines be met or not? **Why?**

