BE1-R3: EMBEDDED SYSTEMS

NOTE:

1. **Answer question 1 and any FOUR questions from 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) What is an embedded system? What are the characteristics of an embedded system?

b) What do you understand by exception handling? Explain, how you can handle exceptions using a programming language of your choice.

c) How data word length is key feature when developing audio algorithms free from noise artifacts?

d) Consider the following preemptive priority- scheduling algorithm based on dynamically changing priorities. Larger priority numbers imply higher priority. When a process is waiting for CPU (in the ready queue, but not running), its priority changes at a rate of a (i.e., $P(t) = P_0 + a * (t - t_0)$ where t_0 is the time at which the process joins the ready queue). Similarly, when it is running, its priority changes at a rate b. All processes are given a priority 0 when they enter the ready queue. The parameters a and b can be set to obtain many different scheduling algorithms.

What is the algorithm that results from $b > a > 0$?

What is the algorithm that results from $a < b < 0$?

e) What are the benefits of using a Digital Signal Processing to process audio signals?

f) What is mutual exclusion? Explain software solution of this problem?

g) What is CAN? Describe various features of CAN.

(7x4)

2.

a) What is Programmable Interrupt Controllers and how Interrupts are handled?

b) The DSP Architecture is optimized for complex mathematical computations by virtue of its various computational units. Discuss this by bringing out the design aspects of ALU, MAC and BARREL SHIFTER.

(9+9)

3.

a) What is modulation and describe various modulation techniques.

b) What is RTOS and describe architecture of real time Kernel.

(9+9)

4.

a) What is the different optimizing design metrics involved in designing an embedded system?

b) Which type of communication network is used by Embedded Systems?

(9+9)

5.

a) What are Serial Communication and Handshaking?

b) What is Scheduling? Define Priority-Based Scheduling.

(9+9)

6.

a) Why Timer Units are most crucial components of Embedded Systems?

b) Differentiate registers from memory. Compare Princeton architecture and Harvard architecture. How is Cache memory related to embedded computing system?

(9+9)

7.

a) As a system administrator you have noticed that usage peaks between 10:00AM to 5:00PM and between 7:00PM to 10:00PM. The company's CEO decided to call on you to design a system where during these peak hours there will be three levels of users. Users in level 1 are to enjoy better response time than users in level 2, who in turn will enjoy better response time than users in level 3. You are to design such a system so that all users will still get some progress, but with the indicated preferences in place.

Will a fixed priority scheme with pre-emption and 3 fixed priorities work? Why, or why not?

Will a UNIX-style multi-feedback queue work? Why, or why not?

If none of the above works, could you design a scheduling scheme that meets the requirements?

b) Most round-robin schedulers use a fixed size quantum. Give an argument in favor of and against a small quantum.

(9+9)