No. of Printed Pages : **2**

Sl. No.

BE1-R4 : EMBEDDED SYSTEMS

NOTE :

1. **Answer question 1 and any FOUR from questions 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) Explain common characteristics of embedded systems with suitable examples.

(b) What types of processors are used in embedded system. If you want to build room temperature controller and car engine controller which processor will you choose and why ?

(c) List and define the three main IC technologies. What are the benefits of using each of the three different IC technologies ?

(d) Given a 120-step stepper motor with its own controller, write a C function or Pseudo code Rotate (int degrees), which, given the desired rotation amount in degrees (between 0 and 360), pulses a microcontroller's output port the correct number of times to achieve the desired rotation.

(e) What is the difference between timer and counters in Microcontrollers ?

(f) Compute the memory needed in bytes to store a 4-bit digital encoding of a 3-second analog audio signal sampled every 10 milliseconds.

(g) How does combination of functions reduce memory requirement in embedded system ? **7x4**

2. (a) Briefly describe the Motorola 68HC11 Architecture and its features.

(b) Discuss the advantages and disadvantages of using memory-mapped I/O versus isolated or standard I/O.

(c) Draw a block diagram of a processor, memory, peripheral, and DMA controller connected with a system bus, in which the peripheral transfers 100 bytes of data to the memory using DMA. Show all relevant control and data lines of the bus, and label component inputs/outputs clearly. Draw a timing diagram showing what happens during the transfer of byte 0 and byte 1 only. **9+4+5**

3. (a) Compose 1Kx 8 ROMs into a 2K× 16 ROMs.

(b) How do you achieve transfer of Multi-byte data set or burst of data or block of data in/out of embedded system. Explain components of it. **9+9**

4. (a) Explain why implementing synchronization primitives by disabling interrupts is not appropriate in a single-processor system if the synchronization primitives are to be used in user-level programs.

(b) Servers can be designed to limit the number of open connections. For example, a server may wish to have only N socket connections at any point in time. As soon as N connections are made, the server will not accept another incoming connection until an existing connection is released. Explain how semaphores can be used by a server to limit the number of concurrent connections.

(c) The semaphore variables full, empty and mutex are initialized to 0, n and 1, respectively. Process P1 repeatedly adds one item at a time to a buffer of size n, and process P2 repeatedly removes one item at a time from the same buffer using the programs given below. In the programs, K, L, M and N are unspecified statements.

P1

while (1) { K; P(mutex); Add an item to the buffer; V(mutex); L; }

P2 while (1) { M; P(mutex); Remove an item from the buffer; V(mutex); N; }

What values does the statements K, L, M and N respectively will have ?

(d) Which scheduling policy is most suitable for time-shared operating system ? **4+4+5+5**

5. (a) List and describe the eight parts of the closed-loop system. Give a real-life example of each.

(b) List and describe three general approaches to improving designer productivity.

(c) Give differences between Controller area networks (CAN) and local area interconnect network difference. **6+6+6**

6. (a) Describe the new challenges created by cores for processor developers as well as users.

(b) What features of JAVA attracts Embedded system development ?

(c) Write Embedded C program to create an approximate 1 sec delay using the Timer 0 for PIC microcontrollers. (4 MHz clock frequency) **6+6+6**

7. Write short notes on **any three** of the following :

(a) Run time exception handling in embedded system

(b) Verification and validation in embedded systems

(c) List down important components of set-up box design

(d) Priority inversion problem in RTOS with example **3x6**

- o 0 o -