

## 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 with appropriate examples why embedded systems are called as dedicated systems?
  - b) Why most of the embedded systems are developed using microcontrollers over general microprocessors.
  - c) List and define the three main processor technologies. What are the benefits of using each of the three different processor technologies?
  - d) Determine whether the following are synchronous or asynchronous. Justify your answer.
    - i) multiplexor
    - ii) register
    - iii) decoder
  - e) What is the difference between timer and watch dog timer in embedded system?
  - f) Given an analog input signal whose voltage ranges from  $-5$  to  $5$  V, and a 8-bit digital encoding, calculate the correct encoding  $1.2$  V, and then trace the successive approximation approach to find the correct encoding.
  - g) What are the types of embedded system?

**(7x4)**
2.
  - a) Explain how memory of 8051 microcontroller is organized. Is it possible to have same addressing space for code and data?
  - b) Draw a block diagram of a processor, memory, and peripheral connected with a system bus, in which the peripheral gets serviced using vectored interrupt. Assume servicing moves data from the peripheral to the memory. Show all relevant control and data lines of the bus, and label component inputs/outputs clearly. Use symbolic values for addresses. Provide a timing diagram illustrating what happens over the system bus during the interrupt.

**(9+9)**
3.
  - a) Briefly define each of the following: mask-programmed ROM, PROM, EPROM, EEPROM, flash EEPROM, RAM, SRAM, DRAM?
  - b) How do you achieve synchronous single byte data transferred in/ out of embedded system? How do you configure the parameters of it?

**(9+9)**
4.
  - a) List three requirements of real-time systems and briefly describe each. Give examples of actual real-time systems to support your arguments.
  - b) Explain why interrupts are not appropriate for implementing synchronization primitives in multiprocessor systems.
  - c) Give pseudo-code for a pair of functions implementing the send and receive communication constructs. You may assume that mutex and condition variables are provided.

**(6+6+6)**
5.
  - a) What are different types of short distance wireless communication devices are available for embedded systems? Describe each of them
  - b) Explain the difference between open-looped and closed-looped control systems. Why are we more concerned with closed-looped systems?

**(9+9)**

**6.**

- a) What is hardware/software co-design? What is a key method for speeding up development of Embedded System?
- b) Write Embedded C program to read a character from serial and display the same for PIC microcontroller (4 MHz clock frequency).

**(9+9)**

**7.** Write short notes on the following (**Any two**):

- a) Task Control Block
- b) Priority Inversion Problem
- c) DMA Controller

**(9x2)**