EMBEDDED SYSTEMS
(AEIE 3231)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
__any 5 (five)__ from Group B to E, taking __at least one__ from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

    (i)   Embedded systems are designed to
            (a) change the state of a device   (b) measure the state of a device
            (c) regulate a physical variable   (d) all of these.

    (ii)   Which of the following is an example of Application Specific Instruction Set
            Processor (ASIP)?
            (a) Intel i3   (b) 8051 Microcontroller
            (c) 8086 Microprocessor   (d) Adreno 610.

    (iii)   The instruction set of CISC processor is
            (a) simple and lesser in number   (b) simple and larger in number
            (c) complex and lesser in number   (d) complex and larger in number.

    (iv)   The number of wires in an I2C bus for a device (master/slave) are
            (a) 2   (b) 1   (c) 8   (d) 10.

    (v)   The number of wires in an SPI for a device (master/slave) are
            (a) 2   (b) 1   (c) 8   (d) 4.

    (vi)   Full Duplex mode of data transfer occurs in 8051 Microcontroller when using
            UART in _____
            (a) Mode 0   (b) Mode 1
            (c) Mode 2   (d) none of the above.

    (vii)   What are valid points about thread?
            (a) Thread are subdivision of process
            (b) One or more threads runs in the context of process.
            (c) Threads can execute any part of process and same part of process can be
                executed by multiple threads.
            (d) All of these.

(viii) In ADC 0808 the purpose of high status of EOC pin is required to indicate
    (a) end of conversion   (b) enable output buffers
    (c) enable input line   (d) output is enabled.

(ix) In Arduino Uno board the number of digital input output pin is
    (a) 10   (b) 12   (c) 14   (d) 16

(x) In Arduino Uno board the number of analog input pin is
    (a) 2   (b) 4   (c) 6   (d) 8.

Group- B

2. (a) What is an embedded system?   [(CO1)(Remember/LOCQ)]
    (b) State in brief a few points of difference between a conventional computer and an embedded system.   [(CO1)(Understand/LOCQ)]
    (c) Discuss the primary challenges involved in an embedded system design.
                                     [(CO1)(Understand/LOCQ)]
                                           2 + 4 + 6 =12

3. (a) What are the differences between RISC and CISC processors? Give an example for each.   [(CO2)(Remember/LOCQ)]
    (b) Explain the role of ASIP in embedded system design.
                                     [(CO2)(Understand/LOCQ)]
    (c) The NRE cost to manufacture a product is Rs.3,50,000/- and per unit cost is Rs.2500/-. Let, the product life is 302 weeks and the product is launched in the market by a delay of 3 week.
      (i) What is actual per unit cost to manufacture 4000 units of the embedded system?
      (ii) Calculate the percentage revenue loss due to delayed product launch.
                                       [(CO1)(Analyse/IOCQ)]
                           (4 + 1) + 3 + (2 + 2) = 12

Group - C

4. (a) Show how a master writes a value 11110000 to a slave address1001101 using I2C bus. Write the steps of operation.   [(CO3)(Apply/IOCQ)]
    (b) Write the purposes of various TWI registers in ATmega32. Describe the bit significance of TWCR.   [(CO3)(Remember/IOCQ)]
                                         4 + (4 + 4) = 12

5. (a) There are 100 bytes of data on external data ROM located at 1000H and send it to Port 1 of 8051. Draw and describe the interfacing of data ROM with 8 bit Microcontroller.   [(CO3)(Design/HOCQ)]
    (b) Describe how the serial data transfer take place following 'I2C Protocol'.
                                       [(CO3)(Explain/LOCQ)]
                                     (4 + 4) + 4 = 12

Group - D

6. Compare Function, Interrupt Service Routine (ISR) and Task. Explain about the States of Task. [(CO5)(Compare/IOCQ)]
(7 + 5) = 12

7. (a) What is RTOS? Describe the task performed by an RTOS.
[(CO4)(Understand/LOCQ)]
   (b) Describe the memory management system in an OS? [(CO4)(Remember/LOCQ)]
(1 + 6) + 5 = 12

Group - E

8. (a) Design a circuit to interface one stepper motor and one DIP switch to Arduino Uno board. Write a program to rotate the stepper motor in clockwise direction when the switch is closed, else rotate it in anticlockwise direction.
[(CO6)(Design/HOCQ)]
   (b) Create an Arduino Uno program that blinks one LED. [(CO6)(Solve/IOCQ)]
(4 + 6) + 2 = 12

9. (a) Design a circuit to interface one temperature sensor (LM35) and one heater to Arduino Uno board. Write a program that measures the temperature and turns ON the heater if it falls below 35°C. Turn off the heater if the temperature rises above 60°C. [(CO6)(Design/HOCQ)]
   (b) What is the sensitivity and temperature measurement range of LM35?
[(CO1)(Understand/LOCQ)]
(4 + 6) + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	31.25	29.17

Course Outcome (CO):

After the completion of the course students will be able to
1. Explain the definitions, components and requirements of the Embedded System
2. Describe the processor, architecture and memory organization of the Embedded System
3. Develop the interfacing and communication techniques of the Embedded System.
4. Learn the basic concept of RTOS
5. Understand the message passing technique, task synchronization techniques
6. Develop algorithms for real time applications of Embedded System

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question