

**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) Measure the state of a device
    - (b) Change the state of a device
    - (c) Regulate a physical variable
    - (d) All of these.
  - (ii) Which of the following is (are) example of Application Specific Instruction Set Processor (ASIP)?
    - (a) Intel Centrino
    - (b) AMD Turion
    - (c) Atmel Automotive AVR
    - (d) All of these
  - (iii) The instruction set of RISC processor is
    - (a) Simple and lesser in number
    - (b) Complex and lesser in number
    - (c) Simple and larger in number
    - (d) Complex and larger in number.
  - (iv) In Little Endian Processor to store a 2 byte of data in memory locations starting from 8000<sub>H</sub> base address which of the following is true
    - (a) 1<sup>st</sup> byte in 8000<sub>H</sub> and 2<sup>nd</sup> byte in 8001<sub>H</sub>
    - (b) 1<sup>st</sup> byte in 8001<sub>H</sub> and 2<sup>nd</sup> byte in 8000<sub>H</sub>
    - (c) 1<sup>st</sup> byte in 8000<sub>H</sub> and 2<sup>nd</sup> byte in 8002<sub>H</sub>
    - (d) 1<sup>st</sup> byte in 8000<sub>H</sub> and 2<sup>nd</sup> byte in 8003<sub>H</sub>.
  - (v) \_\_\_\_\_ mode of data transfer occurs in 8051 Microcontroller during serial data transfer, mode 0.
    - (a) Simplex Mode
    - (b) Half-Duplex Mode
    - (c) Full Duplex mode
    - (d) None of the above
  - (vi) In Automobile industries, \_\_\_\_\_ serial bus protocol is used.
    - (a) RS232
    - (b) CAN
    - (c) I2C
    - (d) None of the above

- (vii) In ADC 0808 the purpose of high status of OE pin is to indicate  
(a) End of Conversion (b) Enable output buffers  
(c) Enable Input line (d) ADC IC is Enabled.
- (viii) In 8051 microcontroller, if the external ROM is accessed  
(a)  $\overline{PSEN} = 1$  (b)  $\overline{PSEN} = 0$   
(c)  $\overline{EA} = 1$  (d) both (a) and (c).
- (ix) The number of wires in an I2C bus for a device (master/slave) are  
(a) 2 (b) 1  
(c) 8 (d) 10.
- (x) In Arduino Uno board resolution of inbuilt ADC is  
(a) 8 (b) 10  
(c) 12 (d) 16.

### **Group – B**

2. (a) What is an embedded system?  
(b) What are the main components of an embedded system? Which are the components used as the core of an embedded system?  
(c) What are the main components of FPGA? With one suitable diagram explain the working of LUT in FPGA.
- $2 + (1 + 2) + (1 + 6) = 12$**
3. (a) What is the difference between RISC and CISC processors? Give an example for each.  
(b) Explain the role of Digital Signal Processor (DSP) in embedded system design.  
(c) The NRE cost to manufacture a product is Rs.3, 00,000/- and per unit cost is Rs.2000/-. Let, the product life is 104 weeks and the product is launched in the market by a delay of 4 week.  
(i) What is actual per unit cost to manufacture 1000 units of the embedded system?  
(ii) Calculate the percentage revenue loss due to delayed product launch.
- $(4 + 1) + 3 + (2 + 2) = 12$**

### **Group – C**

4. (a) Describe how an external code memory is interfaced with an 8 bit Microcontroller with suitable block diagram. Also, write an ALP to load bytes from memory Locations 5000<sub>H</sub> to internal memory spaces (RAM) 50<sub>H</sub> till you are getting a value FF<sub>H</sub> in it.  
(b) Write short Notes on( any One):  
(i) CAN Bus  
(ii) ADC interfacing with 8 bit Microcontroller

**$(2 + 2 + 3) + 5 = 12$**

5. (a) Why is serial mode advantageous over parallel data transfer?  
(b) Describe with a block diagram how a Microcontroller is interfaced with a Modem using RS232 protocols.  
(c) Write and explain an ALP to transmit the ASCII character A continuously using the 8051 serial port. Use 9 bit data at 9600 baud. Use polled operation.

**2 + 4 + 6 = 12**

### **Group – D**

6. (a) What is OS? What should be the goals of an OS?  
(b) List the layers between application and hardware.  
(c) Why does an OS function provide two modes, user and supervisory modes?

**(1 + 4) + 4 + 3 = 12**

7. (a) What are the tasks of PCB in Process Creation?  
(b) Discuss about the role of Process Manager after a process is created?  
(c) Explain the memory managing strategy of a system.

**4 + 4 + 4 = 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 in anticlockwise direction.

- (b) What is the function of AREF pin of Arduino Uno?

**(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 to measure the temperature and turn ON the heater if temperature is below 40°C. If the temperature is above 50°C turn OFF the heater.

- (b) What is the sensitivity and temperature measurement range of LM35?

**(4 + 6) + 2 = 12**

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