

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) Which of the following is used as system core in a 4th generation embedded system?
(a) 16 bit Microprocessor (b) 16 bit Microcontroller
(c) Multi core processor (d) 64 bit Processor.
 - (ii) Internal memory fragmentation occurs in which Memory management technique?
(a) Fixed allocation (b) Variable allocation
(c) Paging (d) Segmentation.
 - (iii) The instruction set of CISC 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 ATmega 32, ADLAR=0 in ADMUX register, indicates the 10 bit output of ADC is configured with
(a) 2 bits from ADCH and rest from ADCL register
(b) 2 bits from ADCL and rest from ADCH register
(c) 5 bits from each of ADCH and ADCL register
(d) none of these.
 - (v) Inside car _____ serial bus protocol is used.
(a) RS232 (b) CAN (c) I2C (d) none of the above
 - (vi) CPU when access programs stored in memory, it actually program from
(a) Secondary to Cache Memory (b) Primary to Secondary Memory
(c) Primary to Cache Memory (d) Secondary to Primary Memory.
 - (vii) In Integrated circuits _____ serial bus protocol is used.
(a) RS232 (b) I2C (c) CAN (d) none of the above

- (viii) The number of wires in an I2C bus for a device (master/slave) are
(a) 2 (b) 1 (c) 8 (d) 10.
- (ix) What language is a typical Arduino code based on?
(a) Assembly Code (b) Python (c) Java (d) C/C++
- (x) What is the microcontroller used in Arduino UNO?
(a) ATmega32114 (b) AT91SAM3x8E
(c) ATmega2560 (d) ATmega328p.

Group- B

2. (a) What is an Embedded Systems? With block diagram briefly discuss the main components of an embedded system? *[[CO1](Remember/LOCQ)]*
- (b) Discuss briefly the advantages and limitations of GPP as system core in an embedded system. *[[CO1](Understand/LOCQ)]*
- (c) Briefly discuss the embedded systems based on complexity and performance requirements. *[[CO1](Remember/LOCQ)]*
(2 + 4) + 3 + 3 = 12
3. (a) What are the differences between RISC and CISC Architectures? *[[CO2](Remember/LOCQ)]*
- (b) Explain the operation of a LUT in an FPGA using a suitable example. *[[CO2](Understand/LOCQ)]*
- (c) The NRE cost to manufacture a product is Rs.5,00,000/- and per unit cost is Rs.500/-. Let, the product life is 300 weeks and the product is launched in the market by a delay of 2 week.
- (i) What is the 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)]*
3 + 5 + (2 + 2) = 12

Group - C

4. (a) Describe the process of data transfer using UART protocol in Microcontroller 8051. Explain the significance of SCON register in serial communication. *[[CO3](Explain/IOCQ)]*
- (b) Describe the operation of 10 bit ADC module of AVR microcontroller. Also specify the names and purposes of the SFRs related to ADC module. *[[CO3](Remember/LOCQ)]*
(3 + 3) + (3 + 3) = 12
5. (a) Write an ALP in Microcontroller 8051 to receive a character from serial port and save this character in R7. Use 9 bit data at 9600 baud. The parity bit can be ignored. Use polled operation. *[[CO3](Solve/IOCQ)]*
- (b) Describe the SPI Bus Protocol with block diagram. *[[CO3](Understand/LOCQ)]*

(c) Describe the significance of following two SFRs of AVR Microcontroller:

(i) SPSR (ii) SPCR.

[[CO2](Explain/LOCQ)]

5 + 3 + (2 + 2) = 12

Group - D

6. (a) What are the different types of Operating Systems ? Which type is used in developing embedded system? Explain its feature. Explain the task of an OS.

[[CO4](Remember/LOCQ)]

(b) What is Kernel? What is the purpose of Kernel?

[[CO5](Analyse/IOCQ)]

(2 + 1 + 2 + 3) + (1 + 3) = 12

7. What is Task? What is purpose of TCB? Explain different task scheduling models of an RTOS.

[[CO4](Remember/LOCQ)]

(2 + 4 + 6) = 12

Group - E

8. (a) Design a circuit to interface one LDR and one LED to Arduino Uno board. Write program that turns OFF the LED if the light intensity exceeds a predefined threshold and turns it ON otherwise.

[[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 LM35 temperature sensor and one LED to Arduino Uno board. Write a program that checks the current ambient temperature and turns on the LED when the temperature exceeds 40°C; otherwise, the LED is turned off.

[[CO6](Design/HOCQ)]

(b) What is the purpose of the analog input pins on the Arduino Uno board?

[[CO1](Understand/LOCQ)]

(4 + 6) + 2 = 12

<i>Cognition Level</i>	<i>LOCQ</i>	<i>IOCQ</i>	<i>HOCQ</i>
<i>Percentage distribution</i>	<i>57.29</i>	<i>21.88</i>	<i>20.83</i>

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.

