

**INTRODUCTION TO EMBEDDED SYSTEMS  
(AEIE 4127)**

**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) ARM processors where basically designed for \_\_\_\_\_
    - (a) main frame systems
    - (b) distributed systems
    - (c) mobile systems
    - (d) super computers .
  - (ii) RISC stands for \_\_\_\_\_
    - (a) Restricted Instruction Sequencing Computer
    - (b) Restricted Instruction Sequential Compiler
    - (c) Reduced Instruction Set Computer
    - (d) Reduced Induction Set Computer.
  - (iii) ARM stands for \_\_\_\_\_
    - (a) Advanced Rate Machines
    - (b) Advanced RISC Machines
    - (c) Artificial Running Machines
    - (d) Aviary Running Machines .
  - (iv) Which of the following provides a buffer between the user and the low-level interfaces to the hardware?
    - (a) Operating system
    - (b) Kernel
    - (c) Software
    - (d) Hardware.
  - (v) In AVR Status Word, sign(s) bit is obtained as
    - (a) Ex-NOR of N bit and V bit
    - (b) Ex-OR of N bit and V bit
    - (c) Ex-NOR of H bit and V bit
    - (d) Ex-NOR of H bit and N bit.
  - (vi) In AT mega 32 the ADC is of
    - (a) 8 bit
    - (b) 10 bit
    - (c) 16 bit
    - (d) 32bit.
  - (vii) The PortB to be initialise as input or output is determined by register
    - (a) PINB
    - (b) DDRB
    - (c) PORTB
    - (d) No one from the above.
  - (viii) "SWAP R10" – the assembly code is used to
    - (a) Exchange the byte information between R0 and R10
    - (b) Exchange the byte information between R9 and R10
    - (c) Exchange the byte information between R10 and R11
    - (d) Exchange the nibbles of R10.

- (ix) In ATmega 328 what is the ISR address for an external hardware interrupt1?  
(a) 0000H            (b) 0002H            (c) 0004H            (d) 0006H
- (x) An Asynchronous mode of serial data transfer is supported by protocol(s)  
(a) UART            (b) I2C            (c) SPI            (d) All of the above.

### Group- B

2. (a) What is an Embedded System? With one suitable block diagram discuss the main components of an embedded system.            [[CO1](Understand/LOCQ)]  
(b) Differentiate between RISC and CISC architectures? Give an example for each.            [[CO1](Remember/LOCQ)]  
(c) Write the main features of ARM.            [[CO1](Remember/LOCQ)]  
**(1 + 6) + 2 + 3 = 12**
3. (a) Compare the Harvard and Princeton architectures.            [[CO1](Compare/IOCQ)]  
(b) Describe various types of computer storage memories.            [[CO1](Classify/LOCQ)]  
(c) Write significance of 'Prescalars' and 'Watchdog Timers' of Microcontrollers.            [[CO1](Explain/IOCQ)]  
**3 + 4 + (2 + 3) = 12**

### Group - C

4. (a) Describe the Internal Data Memory organisation in AVR Microcontroller. Also describe the purpose of 'CY', 'Z', 'S' flags of Status Register.            [[CO2](Interpret/ IOCQ)]  
(b) Write a program to generate a square waveform of period 12.5 microseconds on PortB.3 with a crystal of 8MHz.            [[CO2](Construct/ HOCQ)]  
**(2 + 3) + 7 = 12**
5. (a) With block diagram describe any serial communication technique which support full duplex mode of communication.            [[CO3](Understand/IOCQ)]  
(b) Write an ALP to blink LEDs connected on Port A at same sequence at the same rate. Write delay Subroutine also.            [[CO3](Apply/IOCQ)]  
(c) Write short notes on (*any one*):  
(i) Interrupts of Atmega32  
(ii) TCNT0 and TCCR0 registers.            [[CO3](Understand/LOCQ)]  
**4 + 4 + 4 = 12**

### Group - D

6. (a) What is a Process? How a process is created? What is the purpose of PCB (Process Control Block)? What is the difference between a process and a thread?            [[CO5](Explain/LOCQ)]  
(b) Write a short notes on Layered Model of a System.            [[CO5](Remember/LOCQ)]  
**(1 + 2 + 3 + 2) + 4 = 12**
7. (a) Compare Function, Interrupt Service Routine(ISR) and Task.            [[CO5](Compare/IOCQ)]

(b) Explain about the States of Task.

[(CO5)(Explain/LOCQ)]

6 + 6 = 12

**Group - E**

8. (a) Compare the Command Word and Data word in LCD. [(CO6)(Compare/IOCQ)]

(b) Draw an interfacing circuit of an LCD panel with ATmega32.

[(CO6)(Design/HOCQ)]

(c) Write a program to show how any command word is sent from microcontroller to LCD before any display. Also write another program to set data word to LCD.

[(CO6)(Compile/HOCQ)]

2 + 2 + (4 + 4) = 12

9. (a) Write a program to convert an analog input voltage ( at channel 0) into digital output and display it on the LEDs connected on Port C and Port D using a 10 bit ADC module of ATmega32. Draw necessary interfacing diagram.

[(CO6)(Determine/HOCQ)]

(b) Describe the ADMUX register bit significance.

[(CO6)(Dissect/IOCQ)]

(7 + 2) + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	39.58	33.33	27.08

**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. Acquire knowledge in the area of embedded system using AVR microcontroller.
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

