

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

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

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

Group - A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Number of GPRS in an AVR microcontroller is
(a) 32 (b) 54 (c) 64 (d) none of above.
- (ii) In the ADC module of AVR microcontroller, ADLAR =0, the output is
(a) left adjusted (b) right adjusted
(c) centrally adjusted (d) no adjustment required
- (iii) Number of Special Function Registers in an AVR microcontroller is
(a) 32 (b) 54 (c) 64 (d) none of above.
- (iv) 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.
- (v) Main features of an RTOS
(a) Accurate Output (b) Solve problem within deadline
(c) Fast Output generation (d) None of them.
- (vi) ARM processors are basically designed for
(a) Mainframe Systems (b) Distributed Systems
(c) Mobile Systems (d) Super Computers.
- (vii) Serial communication can take place in ATmega32 using _____ protocol(s).
(a) UART (b) SPI (c) I2C (d) All of the above
- (viii) The vector address shown in Interrupt Vector Table for RESET is
(a) 0002H in Data Memory (b) 0000H in Data Memory
(c) 0000H in Code Memory (d) 0002H in Code Memory.
- (ix) The _____ Serial Communication interface is called Two-Wire Interface
(a) USART (b) SPI
(c) CAN (d) I2C

- (x) In SPI system, in master will always _____ slave device.
 (a) read data from (b) write data to
 (c) generate clock signal to (d) All of the above with

Fill in the blanks with the correct word

- (xi) The ADC module of ATmega32 generates _____ bit digital output.
 (xii) The overflow condition is indicated by _____ flag of TIFR register.
 (xiii) ARM stands for _____.
 (xiv) In Atmega32/16 the _____ is 32k/16k simultaneously.
 (xv) The vector address of RESET in Interrupt Vector Table is _____.

Group - B

2. (a) Define embedded system and compare it with general computing system. *[[CO1](Compare/LOCQ)]*
 (b) Give an example of an Embedded System. Now describe its embedded features. *[[CO1](Understand/LOCQ)]*
 (c) Differentiate between RISC and CISC architecture. *[[CO1](Compare/IOCQ)]*
(1 + 2) + 6 + 3 = 12
3. (a) Describe the main features of ARM processor. *[[CO1](Remember/LOCQ)]*
 (b) Explain with one suitable diagram the working of LUT in FPGA. *[[CO1](Apply/IOCQ)]*
 (c) Differentiate between Harvard and Von-Neumann architectures? Give examples. *[[CO1](Compare/LOCQ)]*
4 + 5 + 3 = 12

Group - C

4. (a) Calculate the time delay generated by Timer0 with TCNT register loaded with 00H. Assume Timer is using XTAL = 8 MHz with no prescaler. *[[CO2](Solve/IOCQ)]*
 (b) Explain the purpose of TCNT0 and TIFR registers. *[[CO2](Remember/LOCQ)]*
 (c) Explain with Timing diagram, how a byte data is read from selected slave using SPI serial communication module of AVR microcontroller. Also explain how the operation is initiated. *[[CO3](Explain/IOCQ)]*
2 + (2 + 2) + (2 + 2 + 2) = 12
5. (a) With example compare the Synchronous and Asynchronous serial communicating protocol? *[[CO3](Remember/LOCQ)]*
 (b) Explain with example, how the arbitration gain /loss occurs in I2C communication, in case of multiple masters are present in the same system. *[[CO3](Remember/LOCQ)]*
 (c) Write and Explain an ALP or AVR C Programme to generate 1milli-second delay with XTAL=8MHz. *[[CO3](Apply/HOCQ)]*
3 + 3 + 6 = 12

Group - D

6. (a) What is Task? What is purpose of TCB? [[CO4](Remember/LOCQ)]
(b) Explain different task scheduling models of an RTOS. [[CO5](Explain/IOCQ)]
(1 + 3) + 8 = 12
7. (a) What are the different types of OS? What are the significances of an OS? Describe its various mode of operation. [[CO4](Analyze/LOCQ)]
(b) Describe various type memory allocation techniques. [[CO5](Understand/IOCQ)]
(2 + 3 + 3) + 4 = 12

Group - E

8. (a) Compare the command and data registers of an LCD. [[CO6](Remember/LOCQ)]
(b) What is the function of RS, R/W and E pins? [[CO6](Remember/LOCQ)]
(c) Draw an interfacing diagram of LCD and Atmega32 using 8 bit for data transfer. Also write an ALP of AVR C code to display your initial on LCD screen. (e.g. student with name: Rekha Kumar, last three digit of autonomy roll no-101, initial of the student would be RK-101). [[CO6](Design/HOCQ)]
2 + 3 + 7 = 12
9. A temperature sensor LM35 is connected to Atmega32 at PortA.0 (LSB). Write an ALP to display the room temperature in binary system in the 8 LEDs connected on the PortB. Draw a neat the circuit diagram and explain the operation. [[CO6](Solve/HOCQ)]
(8 + 2 + 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	44.79	29.17	26.04

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.

