

**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) 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) The microcontroller used inside Arduino UNO-
(a) ATmega16 (b) ATmega328p
(c) ATmega32114 (d) AT91SAM3x8E
- (iii) In ATmega32, the ISR address for _____ is 0000H
(a) External Interrupt 0 (b) Timer0 Overflow interrupt
(c) Reset (d) No one of the above
- (iv) Number of signal lines are used to pursue I2C communications are
(a) 2 (b) 4 (c) 8 (d) 16
- (v) What are valid points about thread?
(a) Thread are subdivision of Process
(b) One or more Threads runs in the context of process.
(c) It can execute any part of process & same part of process can be executed by multiple Threads.
(d) All of these.
- (vi) RTOS can be categorised in to
(a) 2 (b) 3 (c) 4 (d) 5
- (vii) Which one of the following OS is less efficient?
(a) Time sharing OS (b) Multitasking OS
(c) Both (a) and (b) (d) None of these
- (viii) To write a command word to LCD the control signal status would be
(a) RS=0, R/W=0 (b) RS=0, R/W=1
(c) RS=1, R/W=0 (d) RS=1, R/W=1

- (ix) In an 12 bit ADC with 5 V reference voltage, step size would be
 (a) 19.53 mV (b) 4.88 mV
 (c) 1.2 mV (d) 1 mV
- (x) Which of the following can be sequence in a 4 step sequence unipolar stepper motor
 (a) DDH (b) CCH
 (c) BBH (d) Both (a) and (b)

Fill in the blanks with the correct word

- (xi) VHDL is used to design _____ processor.
 (xii) ADC module in ATmega32 can be enabled by _____.
 (xiii) Kernel is _____ in OS.
 (xiv) Alternative purpose of Port A of ATmega16 is _____.
 (xv) Key De-bounce happens _____.

Group - B

2. (a) Define embedded system and compare embedded system and general computing system. [[CO1] (Compare/LOCQ)]
 (b) Give an example of an Embedded System. Now describe its embedded features. [[CO1] (Explain/IOCQ)]
 (c) Define the following: (i) Interpreter, (ii) Assembler, (iii) Simulator. [[CO1] (Define/LOCQ)]
(1 + 2) + 6 + 3 = 12
3. (a) Describe the main components of an embedded system with one suitable block diagram. [[CO1] (Understand/LOCQ)]
 (b) Write short notes on ARM processor. [[CO2] (Remember/LOCQ)]
 (c) Compare the RISC and CISC architectures? Give an example for each. [[CO1] (Compare/IOCQ)]
5 + 4 + 3 = 12

Group - C

4. (a) Explain the ALU operation with suitable block diagram in AVR microcontroller. Draw and describe the Status Register bit pattern of AVR microcontroller. [[CO2] (Interpret/IOCQ)]
 (b) Write significance of Interrupt Vector Table? Describe about various sources of Interrupts in AVR. With example describe how they are enabled and disabled? [[CO2] (Explain/IOCQ)]
(4 + 3) + (3 + 2) = 12
5. (a) Write differences between Synchronous and Asynchronous Communication protocols with example. [[CO3] (Compare/LOCQ)]
 (b) How the data transfer rate is represented in asynchronous data transmission? How it is calculated? [[CO3] (Remember/LOCQ)]

- (c) Explain the data packet format in AVR Microcontroller. With block diagram explain the process of asynchronous data transfer in ATmega32.

[[CO2](Explain/IOCQ)]

$$3 + (1 + 2) + (2 + 4) = 12$$

Group - D

6. (a) What are the different types of OS? Which type of OS is used in embedded system? What is the Significance of an OS? Describe its various mode of operation.

[[CO4](Remember/LOCQ)]

- (b) State the differences between a Function and Service Routine? *[[CO4](Compare/IOCQ)]*

$$(2 + 1 + 4 + 3) + 2 = 12$$

7. (a) Discuss about the various memory allocation Technique. *[[CO5](Explain/LOCQ)]*

- (b) What is Internal and External fragmentation? How this can be fixed? *[[CO5](Understand/IOCQ)]*

[[CO5](Understand/IOCQ)]

$$6 + (2 + 2 + 2) = 12$$

Group - E

8. (a) Write the significance of Command Word and Data word in LCD? How command word register is Initialised? What is the purpose of D0 – D7 pins of LCD?

[[CO6](Analyze/IOCQ)]

- (b) Draw and describe a flowchart, how a key pressed, can be detected in a 4x4 matrix keyboard? What is key de-bounce?

[[CO6](Determine/HOCQ)]

$$(3 + 2 + 1) + (4 + 2) = 12$$

9. (a) Explain the operation of Stepper Motor. 'In a stepper motor the no of tooth is a function of Step size'- Explain. *[[CO6](Analyze/IOCQ)]*

- (b) Write the ALP /AVR C program to rotate Stepper motor with 2 degree step angle, clock wise 120 degree using 4 step sequence. (Show Calculation if any)

[[CO6](Design/HOCQ)]

$$(2 + 2) + 8 = 12$$

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	38.54	46.87	14.59

