EMBEDDED SYSTEMS
(AEIE5 201)

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) Numbers of processing cores the BCM2837 of the Raspberry Pi is
(a) 2 (b) 8
(c) 4 (d) 6

(ii) What is the maximum number of slave devices that can be hooked up to an SPI bus?
(a) 127 (b) 255
(c) 8 (d) Depends on number chip select lines

(iii) On reset the bits of SPCR register are set to?
(a) 0 (b) 1
(c) None of the mentioned (d) Both of the mentioned

(iv) What is the output of the following program?
```
y = 8
z = lambda x : x * y
print(z(6))
```
(a) 48 (b)14
(c) 1 (d) Error

(v) The Atmega328p is a _____ bit microcontroller.
(a) 8 (b) 10
(c) 32 (d) 64

(vi) What will be the output of the following code
```
print(type(type(int)))
```
(a) <class 'int'> (b) <class 'type'>
(c) Error (d) None of the above

(vii) What data type is the object below?
L = [1, 23, 'hello', 1]
(a) Dictionary (b) Tuple
(c) List (d) Array

(viii) If PORTD=0b10000000;
The hexadecimal equivalent contents of PORTD is
(a) 0×17 (b) 0×80
(c) 0×FF (d) 0×C1

(ix) For following command
PORTB = 0x00;
PORTB = (1<<5);
the binary contents of PORTB is
(a) 0b10000000 (b) 0b10000000
(c) 0b00001000 (d) 0b00100000

(x) Which of the following Python function converts a string to float?
(a) int(x [,base]) (b) long(x [,base])
(c) float(x) (d) str(x)

Group – B

2. (a) What advantage does an embedded system have over a conventional computer system? Give two examples where conventional computer system is used over embedded system.

(b) Briefly describe the steps involved in IC fabrication. State the current industrial lithography standard in processor fabrication.

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

3. (a) Give a few points of difference between special purpose and application specific processors. How different are microcontrollers different from application specific processors?

(b) What are the primary challenges involved in an embedded system design? Give a suitable example in support of your answer.

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

Group – C

4. (a) Consider an LED connected to pin 19 (PB5) of an AVR Atmega328p. Write a code to blink this LED two times a second using bit twiddling syntax. Draw necessary circuit diagram.

(b) Explain the working of PINx register in ATmega328p. How can you enable the PINx register? What is the amount of time delay _delay_ms(10000); will give?

(4 + 2) + (2 + 2 + 2) = 12

5. (a) Consider a LM75 connected to ATmega328p at pin 28 and 27, write code to read temperature from the sensor and print it on serial consol. Draw necessary circuit diagram.

   (b) Write a simple code to read light intensity falling on a LDR connected to ADC0 (Pin 23) of an ATmega328p, running at 16MHz clock and print light intensity over serial consol. Draw the circuit diagram for the said problem.

(4 + 2) + (4 + 2) = 12

Group – D

6. (a) What do you understand by an operating system's monolithic kernel? State what role does the __init__ method in a python class play?

   (b) Explain the working of an SPI bus with a suitable functional block diagram. State a few points of differences between the SPI and USART in terms of number of devices addressable.

(3 + 3) + (3 + 3) = 12

7. (a) Write a python program for a Raspberry Pi to read incoming sensor data from serial port '/dev/ttyACM0' at 115200 baud and store it in a CSV file.

   (b) Write a Python code to blink a LED one time a second connected at GPIO7 of a Raspberry Pi.

8 + 4 = 12

Group – E

8. (a) Explain the function of while(1) statement in an AVR code? State the role of ADMUX register.

   (b) State how start and stop bit is denoted in a TWI communication. What role does the SDA line play in TWI communication? What does the TWDR register do?

(2 + 4) + (2 + 2 + 2) = 12

9. (a) Write an AVR application code to check for current ambient temperature using a LM35 temperature sensor and use it to glow a LED connected to pin 17 (PB3) if the temperature goes above 50˚C. Draw necessary circuit diagram.

   (b) Write short note on any **two** of the following:
   (i) Working of a SPI bus
   (ii) Device addressing in SPI and I^2C bus
   (iii) Difference between ASICs and conventional computer systems

(4 + 2) + (2 × 3) = 12

Department & Section	Submission Link
AEIE	https://classroom.google.com/c/MzEyNTU1MDg4MjMy/a/MzczNjUxMjYwMDA0/details