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| **MODEL QUESTION PAPER** | | | | | | |
| **Introduction to Embedded Systems**  **Category: Emerging Technology Courses**  **(Common to all Programs)** | | | | | | |
| **Course Code** | **:** | 22EM111 |  | **SEE** | **:** | **100 Marks** |
|  |  |  |  | **SEE Duration** | **:** | **3.00 Hours** |

***INSTRUCTIONS:***

* **Answer all the questions from Part-A**
* **Answer any 5 full questions from Part-B choosing one from each choice. (Question number 2 is compulsory)**

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| **PART-A** | | | | | | |
|  |  | **Marks** | **CO** | **BTL** | **PO** | **PI CODE** |
| 1.1 | An embedded system is a combination of \_\_\_\_\_\_\_ & \_\_\_\_\_\_\_\_ | 1 | 1 | 1 | **1** | **1.1.1** |
| 1.2 | Which of the following is not the hardware components of an embedded system?  Computer Processor, Linker, Loader, Device Peripherals, Memory, Compiler. | 1 | 1 | 1 | **1** | **2.2.1** |
| 1.3 | Name the embedded system software converts each line of assembly based code to machine based code at a time? | 1 | 1 | 1 | **1** | **1.3.2** |
| 1.4 | How many bit microcontrollers, 8051 and Arduino ATMEGA328P are? | 1 | 2 | 1 | **1** | **1.2.3** |
| 1.5 | How many analog pins available in Arduino Uno Microcontroller? | 1 | 2 | 1 | **1** | **2.4.1** |
| 1.6 | Mention two used of I/O Pins in Arduino Uno Microcontroller? | 1 | 2 | 1 | **1** | **2.3.2** |
| 1.7 | What are int, short and long in Embedded C? | 1 | 2 | 1 | **1** | **3.4.2** |
| 1.8 | Complete the following piece of incomplete code, to set pin number 13 as output and 7 as input.  int ledPin = 13;  int inPin = 7;  void setup() {  pinMode(\_\_\_\_\_\_, \_\_\_\_\_\_);  pinMode(\_\_\_\_\_\_, \_\_\_\_\_\_);  } | 1 | 2 | 2 | **2** | 2.4.4 |
| 1.9 | Fill the blanks in the following code to pauses the program for one minute before toggling the output pin.  int ledPin=13;// LED connected to pin 13  void setup() {  pinMode(ledPin, OUTPUT); // sets the digital pin as output  }  void loop() {  digitalWrite(ledPin, HIGH); // sets the LED on  delay(\_\_\_\_\_\_\_); // waits for a second  digitalWrite(ledPin, LOW); // sets the LED off  delay(\_\_\_\_\_\_\_); // waits for a second | 1 | 2 | 2 | **2** | **3.2.3** |
| 1.10 | In a following code fragment, What is the value stored in variable ‘c’  int a = 92; // in binary: 0000000001011100  int b = 101; // in binary: 0000000001100101  int c = a & b; // result: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_ in decimal. | 1 | 2 | 2 | **2** | **3.5.2** |
| 1.11 | For a 4-bit ADC with voltage range 0-5V, what will be the resolution? Consider Vref=5V | 1 | 3 | 3 | **2** | **2.5.3** |
| 1.12 | If Fs is the sampling frequency and Fm is the maximum frequency of the signal to be sampled, what is the relationship between Fs and Fm for appropriate signal sampling without information loss? | 1 | 3 | 1 | **2** | **3.5.1** |
| 1.13 | The number of comparators required for 4-bit flash ADC is \_\_\_\_\_\_\_\_\_ | 1 | 3 | 3 | **2** | **2.6.3** |
| 1.14 | A 6-bit ladder D/A converter has a maximum output of 10V. The output for input 101001 is approximately. | 2 | 3 | 3 | **3** | **2.4.2** |
| 1.15 | A continuous signal has voltage range of -4V to +2V. If this is quantized to 8 bit, then the step size of the quantizer will be \_\_\_\_\_\_ | 2 | 3 | 3 | **3** | **1.5.4** |
| 1.16 | Which bit is used for error detection in UART communication protocol? | 1 | 3 | 1 | **1** | **2.2.2** |
| 1.17 | The H bridge motor driver is used for \_\_\_\_\_ | 1 | 4 | 1 | **1** | **3.3.2** |
| 1.18 | DC motor works on the principle of \_\_\_\_\_\_ | 1 | 4 | 1 | 1 | 2.2.2 |

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| **PART-B** | | | | | | |
|  |  | **Marks** | **CO** | **BTL** | **PO** | **PI CODE** |
| 2 a. | With neat block diagram, Explain embedded system. Mention at least 5 areas where these embedded systems are playing major role. | 8 | 1 | 1 | **1** | **1.2.2** |
| b. | By considering Washing Machine as a case study, explain how microcontroller and other parts are embedded to perform the intended task. | 8 | 1 | 1 | **1** | **1.3.4** |
|  |  |  |  |  |  |  |
| 3a. | What is microcontroller? List the architectural features of ATMEGA328 microcontroller and mention few differences between microprocessor and microcontrollers. | 6 | 2 | 2 | **1** | **2.4.3** |
| b. | List and explain the following operators in embedded C   1. Arithmetic Operators 2. Bitwise Operators 3. Comparison Operators 4. Boolean Operators | 4 | 2 | 2 | **1** | **2.2.2** |
| c. | Explain the following Control structures in embedded C with general examples.   1. for 2. else 3. while 4. do...while | 6 | 2 | 2 | **1** | **2.4.3** |
|  | **OR** |  |  |  |  |  |
| 4 a. | What is the use IDE tool in embedded programming? Define Editor, Compiler, Linker, Loader, Debugger. | 8 | 2 | 1 | **1** | **3.2.1** |
| b. | With neat interfacing diagram, write a program to interface Temperature sensor with Arduino Uno R3 embedded board**.** | 8 | 2 | 3 | **3** | **3.3.2** |
| 5 a. | Explain the following 3 basic operations in Analog to Digital data conversion with its neat representations.  i) Sampling, ii) Holding and iii) Quantization | 8 | 3 | 2 | **1** | **3.5.1** |
| b. | With schematics of Arduino board, explain working and usages of Port pins and GPIOs. | 8 | 1 | 2 | **1** | **3.5.2** |
|  | **OR** |  |  |  |  |  |
| 6 a. | Explain the following communication Protocols, with its frame formats,  i) UART  ii) I2C | 8 | 3 | 2 | **1** | **3.6.2** |
| b. | Write schematic diagram of interfacing Arduino to control led using push button. Write a programs to do the following.   1. Power on the LED when the button is pressed, and power off the LED when the button is not pressed. 2. toggle the LED’s state only when we release the button. | 8 | 3 | 4 | **3** | **3.7.3** |
| 7 a. | With neat diagram, explain the working of 4-bit Flash ADC | 8 | 3 | 2 | 2 | 2.5.1 |
| b. | A two-bit flash ADC is shown in figure.7. b. The input voltage varies from 0<Vin<5 Volts. Find the digital Output for a given input voltage Vin=2V. Mention the outputs of each stages in the circuit.  2016 paper 1 questions Images Q37  Figure 7.b | 8 | 3 | 3 | 3 | 3.2.1 |
|  | **OR** |  |  |  |  |  |
| 8 a. | With neat circuit diagram, explain the working of R2R ladder type DAC. | 8 | 3 | 2 | 2 | 3.5.1 |
| b. | Draw the interfacing diagram and write a program to measure and display the room temperature using LM35 temperature sensor and Arduino Uno R3 board. Update sensor reading each one second. | 8 | 3 | 4 | 3 | 3.8.2 |
| 9 a. | Write a program to Generate PWM signal with 50% duty cycle on pin number 3. Explain how DC motor speed can be controlled using PWM technique. | 8 | 3 | 4 | 3 | 4.2.2 |
| b. | Why do motor drivers are required to interface motors with Arduino? With neat circuit diagram explain working of H Bridge Motor driver. | 8 | 4 | 2 | 2 | 4.1.2 |
|  | **OR** |  |  |  |  |  |
| 10 a. | With Neat Diagram, Explain the working principle of DC and Stepper motor. | 8 | 4 | 2 | 1 | 4.1.1 |
| b. | Write a program to control the direction of DC motor using Arduino and L298 H bridge IC.  IN1 pin of the L298 IC is connected to pin 8 of the Arduino while IN2 is connected to pin 9. These two digital pins of Arduino control the direction of the motor. The EN A pin of L298 IC is connected to the PWM pin 2 of Arduino. This will control the speed of the motor. The table 10.b shows which direction the motor will turn based on the digital values of IN1 and IN2. | 8 | 4 | 4 | 4 | 3.4.2 |