PROGRAMMING LANGUAGE FOR EMBEDDED IOT SYSTEMS
(AEIE 5102)

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) Which of the following is not a characteristic of cloud computing?
(a) Pay-per-use (b) Elastic capacity
(c) Multitenancy (d) Fixed resources.

(ii) The output seen when '2' == 2 is
(a) False (b) True
(c) ValueError occurs (d) TypeError occurs.

(iii) The processor of Arduino UNO is
(a) 8 bit (b) 10 bit (c) 16 bit (d) 64 bit.

(iv) What is the primary development environment used for Android Things?
(a) Eclipse (b) Visual Studio
(c) Android Studio (d) NetBeans.

(v) What does the acronym MQTT stand for?
(a) Message Queuing Transport Technology
(b) Message Quality Telemetry Transport
(c) Message Queuing Telemetry Transport
(d) Message Queue Transformation.

(vi) L=[10,20,30,40,50,60,70,80,90,100]. The syntax to obtain [20, 40, 60, 80] from the given Python list is
(a) L[[1, 3, 5, 7]] (b) L[1, 3, 5, 7]
(c) L[1::2] (d) L[1:-1:2]

(vii) The function of the statement delay(500) in Arduino UNO is
(a) To introduce a delay of 1s (b) To introduce a delay of 100s
(c) To introduce a delay of 0.5s (d) To introduce a delay of 2s.

(viii) Which connectivity protocols are missing in the default Android OS but are desirable for IoT?
(a) Wi-Fi and Bluetooth (b) Zigbee and LoRa
(c) Ethernet and CAN bus (d) NFC and RFID.

(ix) Which communication method is most commonly associated with MQTT?
(a) Publish-Subscribe (b) Request-Response
(c) Push-Pull (d) Token Ring.

(x) The output of the code str[-1] for str = "Hello" is
(a) "o" (b) "Hell" (c) "Hello" (d) "H"

Fill in the blanks with the correct word

(xi) Elastic capacity in cloud computing ensures that resources can _____ as demand fluctuates.

(xii) MicroPython is a lightweight version of Python designed to run on _____ devices.

(xiii) The baud rate of serial communication in Arduino can be configured using the function _____.

(xiv) Infrastructure as a Service (IaaS) allows users to rent virtualized _____ and storage resources.

(xv) Arduino UNO uses the _____ microcontroller as its core processor.

Group - B

2. (a) Explain the primary differences between Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). *[(CO1)(Understand/LOCQ)]*
(b) How does Google App Engine (GAE) ensure scalability and security for web applications? How does Google App Engine (GAE) ensure scalability and security for web applications? *[(CO2)(Remember/LOCQ)]*
(c) Analyse the key characteristics of cloud computing that make it beneficial for businesses. *[(CO1)(Analyse/IOCQ)]*

3 + (3 + 3) + 3 = 12

3. (a) How do different hypervisors (Type-1 and Type-2) differ in their design and use cases? *[(CO3)(Remember/LOCQ)]*
(b) How many Quality of Service (QoS) levels does the MQTT protocol have? Explain each QoS level in detail. *[(CO1)(Remember/LOCQ)]*
(c) List two application areas where NB-IoT is used over convention WiFi. *[(CO2)(Analyse/IOCQ)]*
(d) Contrast the concept of elastic capacity in cloud computing and how it benefits businesses. *[(CO2)(Understand/LOCQ)]*

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

Group - C

4. (a) Create a Python code using the Flask frame work to implement a RESTful API and use it to serve a GET request to return stored data in JSON format. *[(CO3)(Create/HOCQ)]*

   (b) Explain the role of inheritance in Python classes. Give an example to demonstrate single inheritance. *[(CO4)(Evaluate/HOCQ)]*

   (c) Develop a Python class that implements a student name and grade input system, obtaining the details for at least two students via a parameterized constructor. *[(CO2)(Create/HOCQ)]*

   (d) How can you override a method in Python? Provide an example. *[(CO2)(Remember/LOCQ)]*

4 + 2 + 4 + 2 = 12

5. (a) Develop a basic Python class that accepts data from a USB serial port at a specific baud rate. Implement two class methods to initialize the serial connection and compute the average of the gathered data. *[(CO3)(Analyse/HOCQ)]*

   (b) How are variables declared in a Python class? Show using an example. *[(CO4)(Remember/LOCQ)]*

   (c) What is the storage model of a MongoDB database? *[(CO2)(Remember/LOCQ)]*

   (d) Construct a MongoDB query to find the names of students who have opted for Physics as a major from the collection Subjects of the database Students. *[(CO2)(Apply/IOCQ)]*

5 + 3 + 2 + 2 = 12

Group - D

6. (a) What is the function of void setup() in an Arduino code? *[(CO5)(Remember/LOCQ)]*

   (b) What is the resolution of the ADC in an Arduino UNO? *[(CO4)(Remember/LOCQ)]*

   (c) Develop a Arduino code to blink a LED connected at pin 13 blink one times a second. *[(CO3)(Create/HOCQ)]*

   (d) What is the clock frequency of the Atmega328p processor in an Arduino UNO? *[(CO3)(Remember/LOCQ)]*

4 + 2 + 4 + 2 = 12

7. (a) Identify the AT command used by the ESP-01 to connect with a WiFi access point. *[(CO3)(Apply/IOCQ)]*

   (b) Construct a MicroPython code for NodeMCU to read voltage values from the ADC. *[(CO4)(Apply/IOCQ)]*

   (c) Construct a simple MicroPython code to blink an LED at GPIO 13 in a NodeMCU board. *[(CO5)(Apply/IOCQ)]*

   (d) What is the minimum program space requirement for MicroPython to run? *[(CO2)(Remember/LOCQ)]*

2 + 4 + 4 + 2 = 12

Group - E

8. (a) Explain the role of business analytics in IoT. *[(CO3)(Understand/LOCQ)]*

(b) List the programming languages officially supported by Google for Android Things. *[(CO4)(Remember/LOCQ)]*

(c) Outline the role of predictive maintenance in IoT. *[(CO5)(Understand/LOCQ)]*

4 + 4 + 4 = 12

9. (a) Explain the role of Internet of Things (IoT) and real-time data processing in predictive maintenance. How do these technologies enable more proactive maintenance strategies? *[(CO3)(Understand/LOCQ)]*

(b) List down the various advantages of cellular M2M networks. *[(CO4)(Remember/LOCQ)]*

(c) Show using an example what role predictive maintenance plays in IIoT services. *[(CO2)(Understand/LOCQ)]*

(d) Identify on the role of application layer play in an IIoT solution. *[(CO2)(Apply/IOCQ)]*

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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	59.37	20.83	19.80