PROGRAMMING LANGUAGE FOR EMBEDDED IOT SYSTEMS
(AEI5102)

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) What does PaaS stand for in cloud computing?
(a) Platform as a Service (b) Processing as a Service
(c) Privacy as a Service (d) Performance as a Service

(ii) The protocol layer to which LoRaWAN belongs is
(a) Physical layer (b) Application layer
(c) Session layer (d) Transport layer

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

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

(v) In Python, which keyword is used to define a function?
(a) fun (b) def
(c) function (d) lambda

(vi) The clock frequency of the micro-controller in Arduino UNO is
(a) 16 MHz (b) 1 kHz
(c) 1 GHz (d) 3 GHz

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

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

(ix) What was Google's protocol for device-to-device and device-to-cloud communication before Android Things?
(a) Bluetooth (b) Brillo
(c) Weave (d) Zigbee

(x) Predictive maintenance in IoT typically uses which of the following techniques?
(a) Augmented Reality (b) Machine Learning
(c) Virtual Reality (d) Blockchain

Fill in the blanks with the correct word

(xi) In a Python class, private variables are declared by adding _____ before the variable name.

(xii) Google's IoT strategy evolved from Brillo to _____ to enhance device-to-cloud communication.

(xiii) Edge computing helps reduce latency by processing data at the _____ rather than in the cloud.

(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 does virtualization help in reducing the total cost of ownership (TCO) for businesses? *[(CO3)(Remember/LOCQ)]*
(b) Discuss the types of virtual machines and their use in modern cloud computing environments. *[(CO1)(Create/HOCQ)]*
(c) What are the challenges faced by IaaS providers in managing physical and virtual resources? *[(CO2)(Remember/LOCQ)]*
(d) What are the main architectural components of the Google App Engine (GAE) and their roles in web application hosting? *[(CO2)(Remember/LOCQ)]*

3 + 3 + 3 + 3 = 12

Group - C

4. (a) Develop a simple Python code to demonstrate a MQTT subscriber for topic "home/room_0/humidity_1". *[(CO3)(Create/HOCQ)]*

(b) Create a Python function to reverse a string without using the built-in reverse() method. *[(CO4)(Create/HOCQ)]*

(c) Demonstrate how to return an HTML response using the Flask framework. *[(CO2)(Understand/LOCQ)]*

(d) How do you establish a connection to an MQTT broker in Python using the paho-mqtt library? Provide code to explain. *[(CO2)(Remember/LOCQ)]*

3 + 3 + 3 + 3 = 12

5. (a) Identify the difference between class and instance variable. *[(CO3)(Apply/IOCQ)]*

(b) Create a simple python class to implement a book with name, publisher and page number input system. Obtain the said information for at least two books by a parameterised Python constructor. *[(CO4)(Create/HOCQ)]*

(c) What is the role of the self-keyword in a Python class? *[(CO2)(Remember/LOCQ)]*

3 + 6 + 3 = 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) Compare Arduino UNO and NodeMCU in terms of hardware resources and IoT suitability. *[(CO3)(Understand/LOCQ)]*

(b) Explain the role of AT commands in configuring ESP8266 for IoT applications. *[(CO3)(Remember/LOCQ)]*

(b) Write an Arduino code to read analog input from a potentiometer and display it on the serial monitor. *[(CO4)(Remember/LOCQ)]*

(d) Discuss the role of UART communication in microcontrollers with examples. *[(CO5)(Remember/LOCQ)]*

2 + 4 + 3 + 3 = 12

Group - E

8. (a) Explain with a brief overview of the various value chains involved in a generic M2M solution? *[(CO3)(Understand/LOCQ)]*

(b) Contrast on the role of HAL in Android Things. *[(CO4)(Understand /LOCQ)]*

(c) Identify the role of network cards in the IoT device stack. *[(CO5)(Apply/IOCQ)]*

(d) Identify role do sensors play in a WSN solution? *[(CO6)(Apply/IOCQ)]*

4 + 3 + 2 + 3 = 12

9. (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

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	68.75	11.46	19.79