IOT AND IIOT
(AEI3202)

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

(ii) The shape of a one dimension NumPy array with 5 elements is
(a) (1, 5) (b) (5,) (c) (5, 1) (d) (1,)

(iii)
```
>>>a = [1, 2]
>>>print(a * 3)
```
(a) [1, 2] (b) [3, 6] (c) Error (d) [1, 2, 1, 2, 1, 2]

(iv) The architecture used by ESP8266 is
(a) Xtensa (b) ARM (c) AVR (d) RISC-V

(v) The layer of a neural network that typically performs feature extraction is
(a) Input layer (b) Hidden layer
(c) Output layer (d) Convolution layer

(vi) Performing forward and backwards passes on a neural network model with the entire data set is
(a) an iteration (b) a mini-batch
(c) an epoch (d) regression

(vii) The role of learning rate in training a neural network is
(a) It determines the number of epochs required for training.
(b) It controls the speed at which the model parameters are updated during training.
(c) It defines the number of layers in the neural network
(d) It quantifies the amount of regularization applied during training.

(viii) What is Docker primarily used for?
(a) Virtualizing entire operating systems
(b) Creating lightweight, portable containers for applications
(c) Managing hardware resources for cloud computing
(d) Running machine learning models

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

(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) Strings in Python are _____ data structure.

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

(xiii) The first function that runs in an Arduino code is void _____.

(xiv) NodeMCU uses the _____ communication protocol for transmitting data wirelessly

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

Group - B

2. (a) What are the challenges of implementing NB-IoT in existing cellular networks, and how are they being addressed? *[(CO3)(Remember/LOCQ)]*
(b) What do you understand by a M2M solution? *[(CO1)(Remember/LOCQ)]*
(c) How many Quality of Service (QoS) levels does the MQTT protocol have? Explain each QoS level in detail. *[(CO2)(Remember/LOCQ)]*
(d) What are the primary differences between REST and MQTT in terms of design, complexity, and use cases in IoT? *[(CO2)(Remember/LOCQ)]*

3 + 3 + 3 + 3 = 12

3. (a) Describe the concept of workload isolation in virtualization and how it enhances security and performance. *[(CO1)(Understand/LOCQ)]*
(b) How does Docker optimize application deployment in cloud environments? *[(CO2)(Remember/LOCQ)]*
(c) Discuss the various Docker commands used for managing containers. Explain the use of docker run, docker start, docker stop, docker ps, and docker rm with suitable examples. *[(CO2)(Apply/IOCQ)]*
(d) What are the main deployment models of IaaS, and how do they cater to different user needs? *[(CO2)(Remember/LOCQ)]*

(2 + 1) + 3 + 4 + 2 = 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 any library function. *[(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? Write code to explain. *[(CO2)(Remember/LOCQ)]*

3 + 3 + 3 + 3 = 12

5. (a) Create a Python class Book with attributes for title, author, and number of pages. Write a method to display the book's details. *[(CO3)(Create/HOCQ)]*
   (b) How do you implement inheritance in Python to create a class Ebook that inherits from Book and adds a new attribute for file size? *[(CO4)(Remember/LOCQ)]*
   (c) What is the role of the function super() in a derived class? Explain with an example. *[(CO2)(Remember/LOCQ)]*
   (d) Construct a Python function that counts the number of distinct vowels in a given string. *[(CO2)(Apply/IOCQ)]*

4 + 4 + 2 + 2 = 12

Group - D

6. (a) Develop a simple MicroPython code to print serial data on the console. *[(CO3)(Create/HOCQ)]*
   (b) Develop a simple MicroPython code to read analogue values of a 10 kΩ potentiometer. *[(CO4)(Create/HOCQ)]*
   (c) Develop a simple Arduino code for the ESP32 to read analog voltages a pin 25 in milli volts. *[(CO2)(Apply/IOCQ)]*
   (d) What is the clock frequency of the ESP32 SoC? *[(CO5)(Remember/LOCQ)]*

5 + 5 + 1 + 1 = 12

7. (a) Develop a ESP32 code to upload light intensity gathered from an LDR to the Consentium IoT cloud. Draw the necessary circuit diagram. *[(CO3)(Create/HOCQ)]*
   (b) How will you enable WIFI auto-connect on an ESP32 using Consentium IoT's firmware? *[(CO4)(Remember/LOCQ)]*
   (c) Develop an MicroPython code to read temperature from a LM35 sensor and print it on the serial console. Draw the necessary circuit diagram. *[(CO4)(Create/HOCQ)]*
   (d) Explain the function of Serial.print() and Serial.println() in Arduino code. *[(CO5)(Understand/LOCQ)]*

4 + 2 + 4 + 2 = 12

Group - E

8. (a) How does supervised learning differ from unsupervised learning in neural networks? *[(CO3)(Remember/LOCQ)]*

(b) What is the significance of backpropagation in training neural networks? *[(CO4)(Understand/LOCQ)]*

(c) How is the error computed in a neural network? *[(CO5)(Remember/LOCQ)]*

(d) What is the purpose of the learning rate in weight updates? *[(CO5)(Understand/LOCQ)]*

3 + 3 + 3 + 3 = 12

9. (a) How does gradient descent help in optimizing neural network weights? *[(CO3)(Remember/LOCQ)]*

(b) Why is the sigmoid function commonly used in neural networks? *[(CO4)(Remember/LOCQ)]*

(c) How does changing the number of hidden layers impact neural network performance? *[(CO6)(Analyse/IOCQ)]*

(d) What are some ways to improve the performance of a neural network? *[(CO4)(Remember/LOCQ)]*

3 + 2 + 4 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	59.38	11.45	29.17