INTRODUCTION TO INTERNET OF THINGS
(AEIE 3201)

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 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

(ii) 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

(iii) Which of the following features is common in both LoRa and NB-IoT technologies?
(a) Licensed spectrum usage
(b) Support for high data rates
(c) Low power consumption
(d) Cellular network integration

(iv) d = {0: 'a', 1: 'b', 2: 'c'} print(list(d.keys())) The output of the Python code is
(a) a b c (b) 1 2 3
(c) [1,2,3] (d) 0a 1b 2c

(v) The correct way to obtain "HELLO" from the string src = "hello" is
(a) src.capitalise() (b) src.lower()
(c) src.upper() (d) src.uppercase()

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

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

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

(x) What does the term "epoch" refer to in the context of training a neural network?
(a) The entire dataset passed forward and backward through the neural network once
(b) The number of layers in the neural network
(c) The number of neurons in a neural network layer
(d) The process of initializing the neural network weights.

Fill in the blanks with the correct word

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

(xii) Strings in Python are _____ data structure.

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

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

(xv) The Class A LoRa devices are _____ powered.

Group - B

2. (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

3. (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

Group - C

4. (a) Create a python code to print the last uploaded data on the terminal from Consentium IoT server. *[(CO3)(Create/HOCQ)]*
   (b) How are private class variables declared in a Python class? *[(CO4)(Remember/LOCQ)]*
   (c) What is the function of the send and receive API keys in Consentium IoT server. *[(CO2)(Remember/LOCQ)]*
   (d) What is the role of def __str__(self): in a Python class? *[(CO2)(Remember/LOCQ)]*

5 + 2 + 2 + 3 = 12

5. (a) Develop a Python code using Flask frame work to implement a REST API, use it to serve a GET request by storing incoming data in a MongoDB database? *[(CO3)(Create/HOCQ)]*
   (b) Identify the CRUD query operation to print the first entry in a MongoDB database. *[(CO4)(Apply/IOCQ)]*
   (c) Identify the CRUD operation to delete an entry in a MongoBD database. *[(CO2)(Apply/IOCQ)]*
   (d) What is the role of the on_message() callback function in an MQTT client? *[(CO2)(Remember/LOCQ)]*

4 + 3 + 3 + 2 = 12

Group - D

6. (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

7. (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

Group - E

8. (a) List a few uses of unsupervised learning algorithms. *[(CO3)(Understand/LOCQ)]*
   (b) Draw the structure of an artificial neuron and explain the parts of such a neuron. *[(CO4)(Analyse/IOCQ)]*
   (c) Explain the role of the activation function in deep neural networks. *[(CO5)(Evaluate/HOCQ)]*
   (d) Name a few activation functions commonly used. *[(CO5)(Remember/LOCQ)]*

4 + 3 + 3 + 2 = 12

9. (a) Describe briefly the role of a dropout layer in a neural network. *[(CO3)(Analyse/HOCQ)]*

(b) Show necessary Keras code to implement a dropout layer. *[(CO4)(Remember/LOCQ)]*

(c) What does the reshape layer do in Keras? *[(CO6)(Remember/LOCQ)]*

(d) List the advantages of running machine learning models on the edge in the case of IoT applications. *[(CO6)(Understand/LOCQ)]*

2 + 4 + 2 + 4 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	57.29	23.96	18.75