

**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) The modulation technique used by NB-IoT is
 - (a) FSK
 - (b) ASK
 - (c) QPSK
 - (d) FM
- (ii) The major use of the PaaS cloud is
 - (a) Building
 - (b) Hosting
 - (c) Consumption
 - (d) Compression
- (iii) The methods used by the MQTT protocol are
 - (a) PUT and GET
 - (b) Request and Response
 - (c) Publish and Subscribe
 - (d) POST and DELETE
- (iv) The syntax to obtain [20, 40, 60, 80] from L=[10,20,30,40,50,60,70,80,90,100] Python list is
 - (a) L[[1, 3, 5, 7]]
 - (b) L[1, 3, 5, 7]
 - (c) L[1::2]
 - (d) L[1:-1:2]
- (v) The output of the following Python syntax a='Hello' + str(8) is
 - (a) Hello8
 - (b) Hello 8
 - (c) SyntaxError
 - (d) TypeError

- (vi) The statement that accurately describes implicit data type conversion in Python is
 - (a) Implicit data type conversion requires explicit typecasting.
 - (b) Implicit data type conversion is not supported in Python.
 - (c) Implicit data type conversion occurs automatically during certain operations.
 - (d) Implicit data type conversion can only be performed between numeric data types
- (vii) The total number of digital I/O present in an Arduino UNO board is
 - (a) 8
 - (b) 13
 - (c) 9
 - (d) 14
- (viii) The number of UART I/Os present on the Arduino UNO board is
 - (a) 100
 - (b) 1
 - (c) 14
 - (d) 20
- (ix) In TensorFlow Lite the term "quantization" refers to
 - (a) Reducing the size of a neural network model
 - (b) Converting floating-point weights to fixed-point
 - (c) Normalizing input data to a fixed range
 - (d) Enhancing the precision of numerical calculations
- (x) The primary disadvantage of deploying deep learning models on resource-constrained devices is
 - (a) Increased latency
 - (b) Limited memory capacity
 - (c) Higher energy consumption
 - (d) Reduced model accuracy

Fill in the blanks with the correct word

- (xi) The logic unit of the Arduino UNO is of _____ bit.
- (xii) Strings in Python are _____ data structure.
- (xiii) The ESP8266 microcontroller supports only _____ voltage levels.
- (xiv) Data format used by DNN models when saved using Keras's model save API is _____.
- (xv) An assignment operation to any element of a string yields _____ error in Python.

Group - B

2. (a) What is the role of sensing devices in an IoT system? [[CO1](Remember/HOCQ)]
 - (b) Which modulation technique is used by NB-IoT? State a few advantages of LoRa over NB-IoT. [[CO2](Understand/LOCQ)]
 - (c) Interpret the differences between PaaS and IaaS cloud service. [[CO2](Understand/LOCQ)]
- 4 + (2 + 2) + 4 = 12**

3. (a) Explain in brief the QoS levels used by MQTT. [[CO2](Remember/HOCQ)]
 (b) What do you understand by retained messages in MQTT? [[CO4](Remember/LOCQ)]
 (c) State an application where LoRaWAN is used over conventional WiFi. [[CO2](Apply/IOCQ)]
4 + 3 + 5 = 12

Group - C

4. (a) Write a simple Python class to accept the port name and baud rate via a parameterised constructor. Also, implement a class method to read serial data and generate a CSV file. [[CO3](Analyse/HOCQ)]
 (b) What is the role of the self keyword in a Python class? [[CO4](Remember/LOCQ)]
 (c) Give the CRUD query operation to print the first entry in a MongoDB database. [[CO2](Apply/IOCQ)]
8 + 2 + 2 = 12
5. (a) Write a simple Python code to demonstrate an MQTT subscriber at the topic "home/temperature". [[CO3](Analyse/HOCQ)]
 (b) What is the storage model used by MongoDB? [[CO4](Remember/LOCQ)]
 (c) Write 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)]
6 + 2 + 4 = 12

Group - D

6. (a) Examine the minimum code space requirement for MicroPython to run. [[CO3, CO2](Analyse/IOCQ)]
 (b) Develop a simple MicroPython code to toggle the state of an LED one times a second connected at GPIO 5 in a NodeMCU board. [[CO4](Remember/LOCQ)]
 (c) Describe the software architecture of MicroPython. Comment on how MicroPython is different from RTOS. [[CO2](Apply/IOCQ)]
2 + 6 + 4 = 12
7. (a) Write a simple NodeMCU code to read data from an analogue temperature sensor and upload it to the Consentium IoT Server. Draw the necessary circuit diagram. [[CO4](Understand/LOCQ)]
 (b) What is the architecture of the ESP 8266 microcontroller? [[CO3](Analyse/HOCQ)]
 (c) What is the sensitivity of a LM 35 temperature sensor? Show implementation of a simple Arduino function that takes analog sensor pin as argument and returns temperature in degree Celsius. [[CO4](Remember/LOCQ)]
(4 + 2) + 1 + (2 + 3) = 12

Group - E

8. (a) What do you understand by activation functions in neural networks? Give two examples of activation functions with their nature. [[CO3](Analyse/HOCQ)]

- (b) What is Post Training Quantization? What are the different types of PTQ strategies offered by TensorFlow? [[CO6](Understand/LOCQ)]
- (c) What is the function of model.fit() in Keras? [[CO4](Remember/LOCQ)]
- (2 + 2) + (3 + 3) + 2 = 12**
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9. (a) List a few uses of unsupervised learning algorithms. [[CO5](Remember/LOCQ)]
- (b) Draw the structure of an artificial neuron. Explain the parts of such a neuron. [[CO4](Remember/LOCQ)]
- (c) Explain the role of the activation function. Name a few activation functions commonly used. [[CO2](Apply/IOCQ)]
- 3 + (3 + 3) + (2 + 1) = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	20.8	51.0	28.2

Course Outcome (CO):

After the completion of the course students will be able to

1. Learn and familiarize the design challenges related to IoT systems.
2. Develop Python applications for IoT systems.
3. Demonstrate working knowledge of MicroPython on an ESP 8266 board.
4. Design of an IoT system with an Arduino and ESP 8266 for sensor data acquisition.
5. Understand functional components in an IoT Edge device.
6. Develop machine learning applications for microcontrollers.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question