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) The API key required to write from the Consentium IoT server is
(a) Send API Key (b) Receive API Key
(c) Channel ID (d) Channel No.

(ii) The modulation technique used by NB-IoT is
(a) FSK (b) ASK (c) QPSK (d) SS chirp.

(iii) The architecture used by ESP8266 is
(a) Xtensa (b) ARM (c) AVR (d) x86.

(iv) The major use of the PaaS cloud is
(a) Building (b) Hosting
(c) Consumption (d) Compression.

(v) The data representation format used by RESTful API is
(a) XML and JSON (b) only XML
(c) only JSON (d) HTML

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

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

(xi) The number of ADC ports in a NodeMCU is
(a) 2 (b) 1 (c) 5 (d) 10.

(x) 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].

Fill in the blanks with the correct word

(xi) The status codes in HTTP responses provide information about _____.

(xii) The clock frequency of RP 2040 SoC is _____.

(xiii) The status code of a valid HTTP response is _____.

(xiv) The WSN application that doesn'tuse the internet is _____.

(xv) The data representation format of MQTT is _____.

Group - B

2. (a) List a couple of differences between LoRa and NB-IoT. *[(CO1)(Remember/LOCQ)]*
   (b) Interpret the differences between IaaS and SaaS cloud service *[(CO1)(Understand/LOCQ)]*
   (c) Categorize the data representation formats used by RESTful API. *[(CO1,CO2)(Analyze/IOCQ)]*

4 + 3 + 5 = 12

3. (a) What do you understand by retained messages in MQTT? *[(CO2)(Remember/LOCQ)]*
   (b) Explain the role of topics in MQTT. *[(CO1)(Evaluate/HOCQ)]*
   (c) List the advantages MQTT has over HTTP protocol. *[(CO1)(Analyse/IOCQ)]*

3 + 4 + 5= 12

Group - C

4. (a) Write 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 *[(CO2)(Remember/LOCQ)]*
   (b) How are private class variables declared in a Python class? *[(CO2)(Analyze/LOCQ)]*
   (c) What is the storage model of a MongoDB database? *[(CO3)(Analyze/IOCQ)]*

6 + 3 + 3 = 12

5. (a) Write a simple Python code to demonstrate an MQTT subscriber at the topic "home/temperature". *[(CO2)(Understand/LOCQ)]*
   (b) What is the maximum RAM requirement for MicroPython to run? *[(CO3)(Understand/LOCQ)]*
   (c) Write a simple MicroPython code to blink an LED at GPIO 13 in a NodeMCU board. *[(CO3)(Analyze/IOCQ)]*

5 + 4 + 3 = 12

Group - D

6. (a) Write a simple NodeMCU code to read data from an analog temperature sensor and upload it to Consentium IoT Server. *[(CO4)(Understand/LOCQ)]*
   (b) Which AT command is required to start a TCP server on the ESP 8266 WiFi module? *[(CO3,CO4)(Remember/LOCQ)]*
   (c) What is the function of void setup() in an Arduino code? *[(CO4) (Analyze/IOCQ)]*

6 + 3 + 3 = 12

7. (a) Develop a simple Arduino code to read ambient temperature from an analog temperature sensor (i.e. LM35)and glow a notification LED (at pin 13) if the temperature goes above 80° Celsius. *[(CO4)(Apply/IOCQ)]*
   (b) What is the IEEE protocol standard of the WiFi radio in ESP8266 SoC? *[(CO4)(Understand/LOCQ)]*
   (c) State the number of digital I/O present on an ESP 8266. *[(CO4,CO3)(Analyze/IOCQ)]*

8 + 2 + 2 = 12

Group - E

8. (a) Illustrate with a neat diagram the architecture of Android Things *[(CO4)(Understand/LOCQ)]*
   (b) Contrast on the primary Cloud services that have native support for Android Things based devices? *[(CO6)(Analyze/IOCQ)]*
   (c) Determine the similarities M2M models have with IoT. *[(CO1)(Evaluate/HOCQ)]*

6 + 3 + 3 = 12

9. (a) What advantage does WSN have over IoT? *[(CO4)(Remember/LOCQ)]*
   (b) Outline the role of business analytics in IoT. *[(CO2)(Understand/IOCQ)]*
   (c) Determine the list of programming languages officially supported by Google for Android Things. *[(CO5)(Evaluate/HOCQ)]*

5 + 5 + 2 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	52	38.54	9.37

Course Outcome (CO):

After the completion of the course students will be able to

1. Interpret the vision of IoT from a global context.
2. Understand the key features, design challenges and related to IoT systems.
3. Learn the architecture of NodeMCU and develop IoT systems using it.
4. Demonstrate working knowledge of Micro Python.
5. Design an IoT system with functional requirements for hardware components including processor, networking components and sensors.
6. Develop an IoT system with along with applications of cloud

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