PROGRAMMING LANGUAGE FOR EMBEDDED IoT SYSTEMS (AEIE 5102)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) What does the command "AT+RST" do?
(a) Start a TCP server in the ESP-01 (b) Rest the ESP-01
(c) Sends data over a TCP channel (d) Does nothing.

(ii) What is the resolution of the ADC in an Arduino?
(a) 16 bit (b) 128 bit
(c) 10 bit (d) 32 bit.

(iii) What is the CPU clock frequency of the Raspberry Pi 3 model B?
(a) 16 MHz (b) 1 kHz
(c) 1 GHz (d) 3 GHz.

(iv) MQTT stands for _____ .
(a) MQ Telemetry Things (b) MQ Transport Telemetry
(c) MQ Transport Things (d) MQ Telemetry Transport

(v) The number of GPIO ports in an ESP-01 is _____ .
(a) 2 (b) 10
(c) 3 (d) 0

(vi) >>> s = 'Hello World'
>>> s[1] = 'a'
>>> print s
Which of the following output is seen at console for the above Python code?
(a) Hallo World
(b) Hello World
(c) ld
(d) TypeError: str object doesn't support item assignment.

(vii) The applications for Android Things are mostly written in
(a) Objective C (b) Java
(c) Kotlin (d) Both (b) and (c).

(viii) Which protocol is lightweight?
(a) MQTT (b) HTTP
(c) CoAP (d) SPI.

(ix) The BCM 2836 processor of the Raspberry Pi has ___ numbers of processing cores?
(a) 2 (b) 8 (c) 4 (d) 6.

(x) What will the Linux command "lscpu" do?
(a) Displays list of files in a directory
(b) Deletes the directory
(c) Creates a new directory
(d) Display information about the CPU architecture.

Group – B

2. (a) Explain what do you understand by IaaS cloud service model? State a few benefits of using XaaS over IaaS cloud services?

(b) Explain in details what role does the security and application layer play in IoT functional layers?

(4 + 2) + (3 + 3) = 12

3. (a) What is the major advantage that IoT based solutions offer over a M2M solution, strictly speaking from the application perspective? What are the inputs in a M2M value chain?

(b) State the various inputs to an IoT value chain. How is IoT related to M2M solutions in terms of sensors as their input value chain?

(3 + 3) + (2 + 4) = 12

Group – C

4. (a) What is an empty list in Python and how it can be initialized?
sample_list = [1,3,2]
sample_list[1] = 9
print(list)
What is the output of the above program?

(b) Write a simple python function to accept your name as command line input and print it on the console after omitting the first and last characters of your name.

(3 + 3) + 6 = 12

5. (a) Write a simple Python code to publish a custom message under a selected topic using the paho MQTT client, using "iot.eclipse.org" as the MQTT broker. What do you understand by a MQTT broker?

   (b) Write a Python code using the Flask frame work to implement a RESTapi and use it to serve a GET request by storing incoming data from the API in a SQL database. Consider running the server at the IP address 127.0.0.1:5000.

(4 + 2) + 6 = 12

Group – D

6. (a) What is the maximum RAM space required to run MicroPython? Write a simple MicroPython code to blink an LED at two times a second connected to pin 2.

   (b) Write a simple Arduino code to read data of a digital temperature sensor (i.e. DHT 11) and upload it to the Thingspeak server via an ESP-01. Draw necessary circuit diagram.

(2 + 4) + (4 + 2) = 12

7. (a) What is the maximum code space requirement for MicroPython to run? Write a simple MicroPython code to read/write of an i^2c bus connected device in an ESP8266.

   (b) Which version of the ESP WiFi SoC does the NodeMCU use? Write a code to read LPG gas concentration (in ppm) form an analogue sensor (i.e. MQ2) connected the NodeMCU board.

(2 + 4) + (2 + 4) = 12

Group – E

8. (a) State the advantages of the MQTT protocol for IoT applications. What do you understand by QoS (Quality of Service) in the MQTT protocol?

   (b) How different is Android Things from the conventional Android mobile operating system? What are the primary programming languages officially supported by Google for Android Things?

(3 + 3) + (4 + 2) = 12

9. (a) What advantage does an IoT based system offer over a conventional wireless sensor network? Explain the various building blocks of an IoT applications.

   (b) Write short notes on any two:
   (i) IoT for industrial applications.
   (ii) Role of cloud in the IoT stack.
   (iii) Relation between IoT and data analytics.

(3 + 3) + (3 × 2) = 12