

**INDUSTRIAL INTERNET OF THINGS
(AEIE 5243)**

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) The modulation technique used for LoRa devices is
 - (a) Frequency Hop Spread Spectrum
 - (b) QPSK
 - (c) Chirp Spread Spectrum
 - (d) FSK.
 - (ii) Standard ports of MQTT are _____
 - (a) I2C
 - (b) SSL
 - (c) USART
 - (d) TCP/IP.
 - (iii) MQTT protocol is _____ oriented protocol
 - (a) message
 - (b) file
 - (c) web page
 - (d) none of the above.
 - (iv) Publish command message is sent from _____
 - (a) Only publisher to broker
 - (b) Only broker to publisher
 - (c) Publisher to broker and broker to publisher
 - (d) Server to client.
 - (v) _____ allows control of electronic components
 - (a) RETful API
 - (b) RESTful API
 - (c) HTTP
 - (d) MQTT.
 - (vi) The IIoT applications using Android Things are mostly written in
 - (a) objective C
 - (b) java
 - (c) kotlin
 - (d) python.

- (vii) IIoT Gateway provides the connection between _____ and _____
 (a) cloud and controller (b) network and cloud
 (c) network and controller (d) controller and Device.
- (viii) Both MQTT and CoAP run using _____ standards on _____.
 (a) open, IP (b) closed, UDP
 (c) open, TCP (d) none of the above.
- (ix) What is the foremost attribute for aviation IIoT applications?
 (a) Security (b) Robustness
 (c) both (a) and (b) (d) Connectivity.
- (x) LoRa is a _____ layer protocol.
 (a) MAC (b) physical
 (c) transport (c) session.

Group - B

2. (a) Explain what do you understand by IIoT gateway. State a few benefits of using XaaS over SaaS cloud services.
 (b) Explain through an example the three tiers in an IIoT system.
(4 + 2) + 6 = 12
3. (a) What is fog computing? What role does a fog computer play in an IIoT system?
 (b) Why is data security a huge part of IIoT applications? What role do sensors play in an IIoT solution?
(3 + 3) + (3 + 3) = 12

Group - C

4. (a) Explain the importance of the MQTT protocol in case of IIoT systems. What roles does the read and write API keys play in Thingspeak IIoT server?
 (b) What are the basic requirements of sensor/control network? List down the some applications where the ZigBee network is used.
(4 + 2) + (3 + 3) = 12
5. (a) How different is Bluetooth Low Energy (BLE) from legacy Bluetooth systems? What is the maximum power draw and range of a BLE enabled radio?

- (b) What do understand by a Publish/Subscribe request in MQTT protocol? What is a MQTT broker? What role does a MQTT broker play in IIoT communication?
(4 + 2) + (2 + 2 + 2) = 12

Group - D

6. (a) How is LoRa different from IEEE 802.11 based WiFi networks? What advantages does LoRa offer?
 (b) Which layer of the TCP/IP stack does the LoRa protocol make modifications to? Explain your answer.
(3 + 3) + 6 = 12
7. (a) What do you understand by a Bluetooth piconet? How many concurrent devices are supported in one piconet?
 (b) Write down the basic attributes of Bluetooth 4.0 protocol. How does the Bluetooth 4.0 protocol differ from standard WiFi protocol?
(4 + 2) + (3 + 3) = 12

Group - E

8. (a) What is the allowed maximum concentration value by weight of homogeneous materials like lead, in batteries powering IIoT devices according to RoHS regulations? List the names of few commercial/household devices that have to be RoHS compliant.
 (b) What role does predictive analytics play in IoT services? State using an example.
(3 + 3) + (3 + 3) = 12
9. (a) What do you understand by M2M communication? How different is conventional IIoT from M2M device communication?
 (b) Write short notes on any two:
 i. IIoT for aviation industry
 ii. Role of security in enterprise IIoT
 iii. Relation between IIoT and Data-analytics.
(3 + 3) + (3 × 2) = 12