TELEMETRY & REMOTE CONTROL
(AEIE 4101)

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

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> 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) Which of the following is beneficial for long distance telemetry?
   (a) Transmission of electrical voltage (b) Transmission of electrical current
   (c) Transmission of analogue signal (d) All of (a), (b) and (c).

   (ii) Which of the following is an important part of the receiver end?
   (a) Demodulator (b) Sensor
   (c) End user device (d) None of (a), (b) and (c) .

   (iii) _____ telemetry systems that are susceptible to temperature changes?
   (a) Pneumatic (b) Hydraulic
   (c) Voltage (d) Current.

   (iv) Optical fibres use _____ as a transmission media.
   (a) visible light (b) LASER
   (c) micro-wave (d) both (a) and (b)

   (v) The term 'transponder' is related to
   (a) Satellite communication (b) Fibre optic communication
   (c) GSM communication (d) CDMA communication.

   (vi) Guard band is essential in
   (a) FDMA system (b) TDM system
   (c) CDM system (d) Both TDM and CDM systems.

   (vii) If f_c is the frequency of a signal to be sampled by other signal f_s, then which relation between f_c and f_s is denoted as over sampling?
   (a) $f_s \leq 2 f_c$ (b) $f_s \geq 2 f_c$
   (c) no relation (d) $f_s = 1/2 f_c$.

   (viii) MQTT is _____ protocol.
   (a) Machine to Machine
   (b) Internet of Things
   (c) Machine to Machine and Internet of Things
   (d) Machine Things.

   (ix) In digital telemetry, commonly used modulation is
   (a) AM (b) PCM
   (c) PDM (d) PWM.

   (x) IoT allows data flow between the asset and the users in _____
   (a) single direction (b) both direction
   (c) depends on design (d) None of the mentioned.

Group – B

2. (a) Explain with a neat diagram the working of a pneumatic telemetry system. What advantage does pneumatic telemetry offer over hydraulic telemetry based system?

   (b) Draw the basic block diagram of the receiver side of current telemetry system. Briefly describe the functional blocks of the receiver side.
   (3 + 3) + (2 + 4) = 12

3. (a) Why TCP (Transport Layer Protocol) is called a connection oriented protocol? State four attributes of TCP. How does TCP offer full-duplex communication?

   (b) Briefly describe the various layers of Bluetooth architecture with a neat diagram. Explain what is a Bluetooth piconet?
   (3 + 1 + 2) + (4 + 2) = 12

Group – C

4. (a) Explain the working a TDM based telemetry system with a proper block diagram. What do you understand by guard band in FDM systems? State few points of difference between TDM and FDM systems.

   (b) Explain the working of QPSK (Quadrature Phase Shift Keying) systems. What advantages does QPSK have over BPSK (Binary Phase Shift Keying)? What do you understand by quantization?
   (2 + 1 + 3) + (3 + 2 + 1) = 12

5. (a) State what do you understand by a node in wireless sensor network? Explain in brief with a neat diagram the various components of node.

(b) What advantage does QAM (Quadrature Amplitude Modulation) provide over conventional AM and PM systems? Explain how a 16-QAM that uses 4bits as 1 symbol work?

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

Group – D

6. (a) State the main reasons behind attenuation in optical fibres? What do you understand by modes in optical fibre? Classify optical fibres based on modes.

(b) What do you understand by footprint of a satellite? State few advantages and disadvantages of satellite communication systems?

(3 + 1 + 2) + (4 + 2) = 12

7. (a) State along with the frequency range of the two types of wave propagation earth based transmitters and receivers use. What are the advantages of a satellite based communication system?

(b) Explain the working of ALOHA protocol with a flow diagram? State the six attributes that are used to describe the orbital motion of a satellite.

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

Group – E

8. (a) State the characteristics of the MQTT protocol. What role does the application layer in the IoT solution stack play?

(b) What advantage does IoT solutions have over a wireless sensor network in case of industry applications?

(2 + 4) + 6 = 12

9. (a) Explain in details what does the Publish/Subscribe methods do in the MQTT protocol? How are topics defined in the MQTT protocol?

(b) Write short note on any two of the following
    (i)   Current verses voltage telemetry system
    (ii) FDM architecture
    (iii) MQTT broker in IoT systems.

(4 + 2) + (3 × 2) = 12