

**INSTRUMENTATION AND TELEMETRY  
(AEIE 4121)**

**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) Which one of the following represents active transducer?  
(a) Thermistor            (b) LVDT            (c) Strain Gauge            (d) Thermocouple.
- (ii) Magnetostrictive transducer can be used to measure \_\_\_\_\_.  
(a) force            (b) acceleration            (c) torque            (d) all of these
- (iii) In 4 – 20 mA signal that corresponds to 0 – 100% scale, what would be the current at 50%?  
(a) 4 mA            (b) 8 mA            (c) 12 mA            (d) 16 mA.
- (iv) The sensitivity of a potentiometer can be increased by  
(a) decreasing the thickness of the potentiometer wire  
(b) increasing the length of the potentiometer wire  
(c) increasing the temperature of the surrounding  
(d) all of the above.
- (v) Which of the following represents the lower and upper range of standard industrial pressures?  
(a) 0 – 10 psi            (b) 0 – 15 psi            (c) 3 – 10 psi            (d) 3 – 15 psi.
- (vi) Rotameter is a  
(a) drag force flow meter            (b) variable area flow meter  
(c) variable head flow meter            (d) rotating propeller type flow meter.
- (vii) Which of the following conversion takes place in Bourdon tubes?  
(a) Pressure to displacement            (b) Pressure to voltage  
(c) Pressure to strain            (d) Pressure to force.
- (viii) QPSK system uses a phase shift of  
(a)  $\Pi$             (b)  $\frac{\Pi}{2}$             (c)  $\frac{\Pi}{4}$             (d)  $2\Pi$ .
- (ix) In digital telemetry commonly used modulation is  
(a) PPM            (b) PCM            (c) PWM            (d) PAM.

- (x) Full form of MQTT \_\_\_\_\_  
(a) Message Queuing Telemetry Transport  
(b) Message Queuing Telegram Transport  
(c) Message Queue Telegram Transport  
(d) Message Queue Telemetry Transport.

### Group - B

2. (a) Draw the basic block diagram of the receiver side of current telemetry system. Briefly describe the functional blocks of the receiver side. [[CO1](CO5)(Remember/LOCQ)]  
(b) Design and explain a voltage telemetry system for data transmission of liquid level to some remote location. [[CO1](CO5)(Evaluate/HOCQ)]  
**(3 + 3) + 6 = 12**
3. (a) Define piezoelectric effect. Find the expression for voltage sensitivity of a piezoelectric transducer. [[CO2](Analyze/IOCQ)]  
(b) Explain the principle of working of light dependent resistors? [[CO2](Analyze/IOCQ)]  
(c) What do you mean by 'dark resistance' of photo resistor? (CO2)(Understand/LOCQ)]  
(d) What are the main features of photodiode? [[CO2](Understand/LOCQ)]  
**(2 + 3) + 3 + 2 + 2 = 12**

### Group - C

4. (a) With neat diagrams explain the construction and working of McLeod gauge for non-linear type. Why is a McLeod gauge considered to be a standard for measurement of pressure in the vacuum range? [[CO3](Understand/LOCQ)]  
(b) How volumetric flow rate (Q) is measured by a Rotameter? What modification should be done if the liquid is denser than float? [[CO3](Analyze/LOCQ)]  
**(4 + 2) + (4 + 2) = 12**
5. (a) Explain with a neat diagram, how a differential transmitter can be used to measure the liquid level of a closed tank.? [[CO3](Evaluate/HOCQ)]  
(b) What do you mean by PT<sub>100</sub>? [[CO3](Understand/LOCQ)]  
(c) What is meant by cold junction compensation of thermocouple? Describe one technique for cold junction compensation. [[CO3](Understand/LOCQ)]  
(d) Why is lead compensation not required in Thermistor for temperature measurement? [[CO3](Analyze/IOCQ)]  
**4 + 1 + (2 + 3) + 2 = 12**

### Group - D

6. (a) Draw the block diagram of a frequency telemetry system and briefly explain it. [[CO5](Remember/LOCQ)]

- (b) Draw and explain the circuit of a current to voltage converter. How a voltage to frequency converter can be designed for frequency telemetry system?

[[CO4](Understand/LOCQ)]

4 + (3 + 5) = 12

7. (a) Why and how the signal is required to be conditioned before transmission in a telemetry system?

[[CO4](Analyze/IOCQ)]

- (b) What is Fiber-optic communication system? What are the components of optical fiber communication system?

[[CO6](Understand/LOCQ)]

- (c) What is quantization error and how does signal to noise relate to this?

[[CO6](Understand/LOCQ)]

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

### Group - E

8. (a) Explain with a neat diagram how FSK (Frequency Shift Keying) works?

[[CO6](Remember/LOCQ)]

- (b) Compare among ASK, FSK and PSK.

[[CO6](Analyze/IOCQ)]

- (c) Explain with block diagram the operation of BPSK modulator and demodulator.

[[CO6](Analyze/IOCQ)]

3 + 3 + (3 + 3) = 12

9. (a) What do you understand by QoS (Quality of Service) in case of MQTT protocol for IoT systems?

[[CO6](Analyze/IOCQ)]

- (b) Explain the basic differences between the MQTT protocols from HTTP.

[[CO6](Understand/LOCQ)]

- (c) Write a short note on power system telemetry.

[[CO5](Analyze/IOCQ)]

4 + 4 + 4 = 12

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	56.26	33.33	10.41

### Course Outcome (CO):

After the completion of the course students will be able to

1. Understand different blocks of generalized measurement system.
2. Clarify operation of indigenous sensors and transducers.
3. Gain knowledge of measurement system for industrial parameters like pressure, flow, level and temperature.
4. Design various signal conditioning circuits for sensors.
5. Select telemetry system required for a given application.
6. Justify the need of process data multiplexing and de-multiplexing in telemetry

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

