INSTRUMENTATION AND TELEMETRY
(AEIE 4181)

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 used for con-contact type temperature measurement?
   (a) Thermocouple   (b) RTD
   (c) Thermistor   (d) Pyrometer.

   (ii) McLeod gauge is used for measuring very low pressure of about
   (a) $10^{-1 \text{ to }} 10^{-3}$ Torr   (b) $10^{1 \text{ to }} 10^3$ Torr
   (c) $10^{-4 \text{ to }} 100^{-6}$ Torr   (d) $10^{4 \text{ to }} 10^6$ Torr.

   (iii) Sensitivity of a K-type thermocouple is 38.8 µv/°C. If the temperature of hot and cold junction be 250°C and 60°C respectively, the output voltage recorded by the voltmeter is
   (a) 2.14mV   (b) 7.37mV   (c) 9.31mV   (d) 12Mv.

   (iv) J-type thermocouple is made by
   (a) copper-constantan   (b) iron-constantan
   (c) chromel- alumel   (d) chromel- constantan.

   (v)   Pt-100 means the resistance of the RTD
   (a) at 0°C is 100 ohms   (b) exhibits 100 ohms at 100°C
   (c) at 100°C is 200 ohms   (d) exhibits 400 ohms at 100°C.

   (vi) For a PLL chip NE565 the external resistance and capacitance are given by 10KΩ and 500pF respectively. The free-running frequency of the PLL is
   (a) 20kHz   (b) 60kHz   (c) 100kHz   (d) 20MHz.

   (vii) Venturimeter works on the principle of
   (a) Archimedes   (b) Peltier effect
   (c) Seebeck effect   (d) Bernoulli's.

   (viii) By using thermowell assembly in temperature speed of response of the temperature sensors
   (a) decrease   (b) remain same
   (c) increase linearly   (d) increase exponentially.

(ix)   In current telemetering system the range of current signal is
(a) 0–20 mA   (b) 4–10 mA   (c) 0–100 mA   (d) 4 - 20 mA.

(x)   Optical pyrometer is used to measure
(a) light intensity of light   (b) low temperature
(c) high temperature   (d) high pressure.

Group – B

2. (a)   Name the different types of diaphragms. Draw and explain the arrangement of diaphragms used to measure absolute pressure.

(b)   With a neat diagram, describe vacuum pressure measurement by McLeod gauge.

(2 + 4) + 6 = 12

3. (a)   Show how the volumetric flow rate for head type flowmeter is related to the differential pressure head h.

(b)   With a neat diagram explain the operation of a pitot tube for the measurement of fluid velocity.

7 + 5 = 12

Group – C

4. (a)   Design a scheme of level measurement and transmission using float gauge with differential bellows element and explain the operation.

(b)   How liquid level is measured using resistive method?

7 + 5 = 12

5. (a)   Draw the construction of a tip sensitive resistance temperature detector (RTD). How an unknown temperature is measured by RTD with its proper signal conditioning circuit in deflection mode?

(b)   Why are 3-wire and 4-wire RTD connections preferred to measure temperature? Draw the circuit of 4-wire connection of RTD. What is self -heating problem of RTD?

(2 + 5) + (1 + 2 + 2) = 12

Group – D

6. (a)   Design and explain a voltage telemetry system for data transmission of liquid level to some remote location.

(b)   Draw a voltage to current converter circuit and hence make the circuit analysis of it.

6 + 6 = 12

7. (a)   With a neat block diagram explain how sensor data is transmitted to remote end using frequency telemetry system?

(b) Design a voltage to frequency converter circuit and show how the input voltage is related to frequency.

6 + 6 = 12

Group – E

8. (a) How multiple sensor data is transmitted using PAM/PM/PM scheme in time division multiplexing system?

(b) How the transmitted data at the receiving end are retrieved in time division multiplexing system?

6 + 6 = 12

9. (a) Draw the block diagram of phase locked loop (PLL) and explain its operation.

(b) What are lock range, capture range and free running frequency of PLL?

(2 + 5) + 5 = 12

Department & Section	Submission link:
EE	https://classroom.google.com/c/MTM4Mzk2MTUxMDEy/a/MjcxMTQ1OTE3MDk1/details
ChE	https://classroom.google.com/c/MTM4Mzk2MTUxMDEy/a/MjcxMTUyNjA1MDA5/details