

**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 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)**

- Choose the correct alternative for the following: **10 × 1 = 10**
 - Non-contact type temperature measurement is done by
 - RTD
 - thermistor
 - optical pyrometer
 - thermocouple.
 - In case of temperature measurement using thermowell assembly speed of response of the temperature sensors
 - increase linearly
 - decrease
 - remain same
 - increase exponentially.
 - In case of rotameter the volumetric flow rate (q) is related to the height (h) of the float from the inlet by the relationship
 - q directly proportional to h
 - q directly proportional to $h^{1/2}$
 - q directly proportional to $h^{1/3}$
 - q inversely proportional to h.
 - Pt-100 means the resistance of the RTD
 - at 0°C is 100 ohms
 - exhibits 100 ohms at 100°C
 - at 100°C is 200 ohms
 - exhibits 400 ohms at 100°C.
 - If the maximum frequency component of a modulating signal is f_m then for distortion less transmission the sampling frequency f_s is
 - $f_s > = 2 f_m$
 - $f_s < = 2 f_m$
 - $f_s > = f_m$
 - $f_s < = f_m$.
 - In digital telemetry commonly used modulation is
 - PPM
 - PCM
 - PWM
 - PAM.

- Optical pyrometer is used to measure
 - light intensity of light
 - low temperature
 - high temperature
 - high pressure.
- In McLeod gauge the range of measurement of pressure is
 - 10^{-1} to 10^{-3} torr
 - 1 to 2 torr
 - 2 to 4 torr
 - 5 to 8 torr.
- J-type thermocouple is made by
 - copper-constantan
 - iron-constantan
 - chromel-alumel
 - chromel- constantan.
- At 0°C the resistance of standard platinum resistance thermometer (SPRT) is
 - 100 Ω
 - 20.5 Ω
 - 25.5 Ω
 - 10.5 K Ω.

Group - B

- Define absolute pressure, gauge pressure and differential pressure.
 - With a neat diagram, describe the construction and operation of McLeod gauge for the measurement of vacuum pressure. Show how pressure is calculated by this method. What is the limitation of this method and how is it removed? **3 + (5 + 2 + 2) = 12**
- Explain the construction and operation of a variable area type flow meter. Show how the volumetric flow rate is related to the height of the float from the inlet.
 - What is the basic principle behind the electromagnetic flow meter? **(5 + 4) + 3 = 12**

Group - C

- Why cold junction compensation is required in thermocouple? How a cold junction compensation circuit can be designed for continuous temperature measurement?
 - Calculate the temperature of a furnace, if the cold junction temperature is 34°C and voltmeter gives 41.15 mv for the furnace temperature. A chart of temperature vs voltage of the thermocouple when cold junction at 0°C is given below:

Temperature (°C)	Voltage (mv)
30	1.203
40	1.611
1030	42.432
1040	42.817

(2 + 5) + 5 = 12

5. (a) How the level of a non-conducting fluid is measured by capacitive method?
(b) How a liquid level control scheme can be designed by using magnetic type float?

$$6 + 6 = 12$$

Group - D

6. (a) Draw the block diagram of a frequency telemetry system and briefly explain it.
(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?

$$4 + (3 + 5) = 12$$

7. (a) State sampling theorem.
(b) What is amplitude modulation? Show how the double side band - suppressed carrier modulation is obtained in amplitude modulation. What is its required transmission bandwidth?

$$2 + (3 + 6 + 1) = 12$$

Group - E

8. (a) What is frequency division multiplexing? With necessary diagrams briefly explain the transmission and reception of multiple sensor data in this technique.
(b) What is cross-talk in FDM system?

$$(2 + 8) + 2 = 12$$

9. (a) What is PLL? With a block diagram explain how it works. How can FM demodulator circuit be designed using PLL?
(b) Make comparisons between TDM and FDM.

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