

B.TECH/ EE/ME /7TH SEM/AEIE 4181/2018
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)

1. Choose the correct alternative for the following: **10 × 1 = 10**

- (i) 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.
- (ii) Which of the following types of Bourdon tube shape has a small tip travel and necessitates amplification?
(a) C-Type (b) Spiral (c) Helical Shape (d) All of These.
- (iii) The range of level measurement in float type level measurement is
(a) 10 cm – 20 m (b) 5 cm – 100 m
(c) 15 cm – 200 m (d) 10cm – 500 m.
- (iv) In ultrasonic level gauge, the ultrasonic source is placed at the
(a) bottom of the vessel containing the liquid
(b) top of the vessel containing the liquid
(c) middle of the vessel containing the liquid
(d) far from the vessel containing the liquid.
- (v) For a K-type thermocouple, sensitivity is 38.8 $\mu\text{V}/^\circ\text{C}$. If the temperature of hot and cold junction be 300°C and 60°C, the output voltage recorded by the voltmeter is
(a) 2.14mV (b) 5.02mV (c) 9.31mV (d) 12mV.
- (vi) For a PLL chip NE565 the external resistance and capacitance are given by 10K Ω and 500pF respectively. The free-running frequency of the PLL is
(a) 20kHz (b) 60kHz (c) 100kHz (d) 20MHz.

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- (vii) J-type thermocouple is made by
(a) chromel- constantan (b) iron-constantan
(c) chromel-alumel (d) copper- constantan.
- (viii) An electronic level transmitter with a 4 - 20 mA output is calibrated to level range of 10 cm to 100 cm. If the transmitter output is 12 mA then the liquid level is
(a) 55 cm (b) 67.5 cm (c) 75cm (d) 45cm.
- (ix) A flow with a high Reynolds number indicates that the flow is
(a) laminar (b) erratic (c) turbulent (d) transitional.
- (x) 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

Group – B

2. (a) What will be the gauge pressure and absolute pressure at a depth of 35 metre in a water tank? Express them in kg/cm² and mmHg.
(b) What are the different types of Bourdon tube gauges? Describe the construction and working of C-type bourdon tube gauge with a neat diagram. Write its advantages and disadvantages.
3. (a) Derive an expression of the volumetric flow rate of an orifice meter. What is the reason behind the permanent pressure drop across an orifice meter?
(b) A sharp edged circular orifice is to be used to measure the flow rate of the water at 20°C ($\rho=1000\text{kg/m}^3$, $\mu= 1 \text{ m pa s}$) in a pipeline with a internal diameter 250mm. The orifice diameter is 50mm. The reading of a Hg manometer at the throat tap position is 242 mm ($\rho_m=13600\text{kg/m}^3$). Calculate the flow rate in l/s.

2 + (2+ 4 + 4) = 12

(5 + 2) + 5 = 12

Group – C

- 4.(a) How lead resistance effect of RTD in 2-wire connection is minimized in 3-wire and 4-wire connections? What is self heating problem of RTD? How can it be minimized?
(b) Design and explain a cold junction compensation scheme for thermocouple using IC temperature sensor.

(6+1 + 1) + 4 = 12

- 5.(a) How a liquid level transmitter can be designed using float gauge with differential bellows element?
- (b) Explain a resistive type liquid level measurement scheme.

7 + 5 = 12

Group - D

6. (a) Draw the schematic block diagram of a telemetry system identifying different parts in it.
- (b) Why and how the signal is required to be processed or conditioned before transmission by such a system. (given above in 6(a)).

6 + (2 + 4) = 12

7. (a) Draw the sketches of voltage and current telemetry schemes using wires. Compare their advantages and disadvantages.
- (b) How voltage is converted into current in telemetering system? Explain with suitable diagram and analysis.

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

Group - E

- 8.(a) Design and explain the circuit in the transmitting end for signal transmission in frequency division multiplexing.
- (b) How the original sensor data is retrieved at the receiving end in frequency division multiplexing?

6 + 6 = 12

- 9.(a) What is free running stage of PLL? What are lock range and capture range of PLL?
- (b) What will be the output frequency of VCO if external capacitance is 500pF, external resistance is 10Kohm, dc control voltage is 10V and supply voltage $V^+=12$ V. Make comparisons between FDM and TDM.

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