*Total number of printed pages: 2*

**UG/Sem-V/UIE503**

**2023**

# INDUSTRIAL INSTRUMENTATION

*Full Marks: 100*

Time: Three hours

***The figures in the margin indicate full marks for the questions.***

*Answer **any five** questions.*

*Symbols have their usual significances.*



1 a) Define the terms: Absolute pressure, Atmospheric pressure, Gauge pressure and Vacuum. 4

Convert the following: 4

(i) 15 psi into kPa (ii) 150 Torr into Bar

b) Explain, with the schematic diagram, the principle of operation of Mcleod gauge. 8

c) The pressure in ionization gauge chamber is $3.5 \times 10^{-5}$ Torr for a plate current of $8.5 \times 10^{-6}$A. What should be the grid current to have a sensitivity of 180/Torr? 4

2 a) Write down the R-T relationship for Pt RTD and NTC type thermistor. What are the differences between a Pt RTD and an NTC type thermistor? 6

b) Determine A for a thermistor having $\beta$ = 4200K and resistance 50 k$\Omega$ at $25^0$C. Calculate the value of temperature coefficient of resistance (TCR) of thermistor at $150^0$C. 4

c) Explain, with the schematic diagram, the operation of optical pyrometer. 10

3 a) Starting from Bernoulli's theorem, derive the volume flow rate for Venturimeter. 12

Draw the pressure variation curve for Venturimeter. 2

b) What are the different types of tapping in orifice plate flow meter? 6

4 Explain, with the schematic diagram, the principle of operation of (i) Pitot tube flow meter, and (ii) Doppler shift ultrasonic flow meter. 8+8

Mention their advantages and disadvantages. 4

5 Explain, with the schematic diagram, the principle of operation of (i) purge or bubbler method and (ii) ultrasonic level gauge for liquid level measurement. 8+8

Mention their advantages and disadvantages. 4

6 Explain, with the schematic diagram, the principle of operation of flapper-nozzle system. 10

Explain how a flapper–nozzle system can be used to develop a current to pressure converter. 10

7 Write short notes on any two of the following: 10x2=20

a) Transit time ultrasonic flow meter

b) Cold cathode ionization gauge

c) Pressure to current converter

d) Vortex shedding flow meter



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