Exam Date & Time: 13-Jan-2021 (02:00 PM - 05:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.TECH GRADE IMPROVEMENT SEMESTER EXAMINATIONS, JAN-2021

INDUSTRIAL INSTRUMENTATION [ICE 2252]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

1) Why is cold junction compensation required for a thermocouple? Explain with suitable diagram, two methods of implementation. (5)

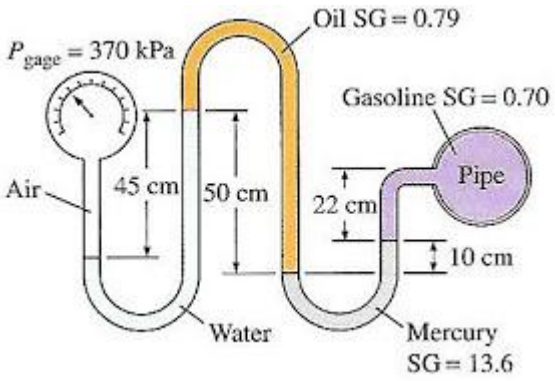
A)

B) For a certain NTC thermistor β = 3100 K and its resistance at 20°C is known to be 2300Ω. The thermistor is used for temperature measurement and the resistance measured is 1050Ω. Find the measured temperature. (2)

C) An RTD has a resistance of 500Ω at 20°C and a temperature coefficient of 0.005Ω/°C at 0°C. The RTD is used in a Wheatstone bridge circuit with $R_1 = R_2 = 500\Omega$. The variable resistance R_3 nulls the bridge. If the bridge supply is 10V and the RTD is in a bath of 0°C, find the value of R_3 to null the bridge without considering self-heating of RTD. (3)

2) A multi-tube manometer using air, water, mercury and gasoline is used to measure the pressure of gasoline in a vessel as shown in the figure. Calculate the gauge pressure in the gasoline vessel.

A)



(4)

B) Describe construction and working of Dead weight tester. (3)

C) Describe construction and working of Knudsen gauge. (3)

3) With the help of a diagram, explain the working principle of a rotameter. Also derive the expression of mass flow rate for the same. (5)

A)

B) Water flows through orifice of 25mm diameter situated in a 75mm pipe at the rate of $3x10^{-4}$ m^3/s. What will be the difference in level in two legs of a H_2O manometer connected across the orifice meter if the coefficient of discharge of the meter is 0.61? (3)

C) Explain working principle of a vortex flowmeter. Use suitable diagram. (2)

4) With suitable circuit diagram, explain measurement of mass flow rate using Coriolis flowmeter. (4)

A)

B) Multiphase flow is formed by mixing water, oil and gas. Explain the different ways of measuring flow rate of the mixture? (3)

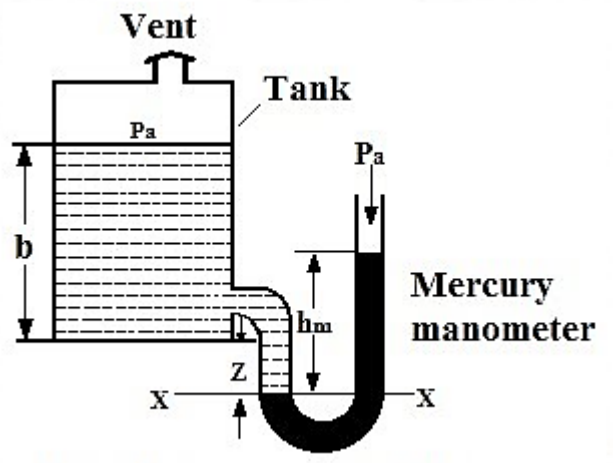
C) Discuss in detail the construction and working of a twin-turbine flowmeter with a suitable diagram. (3)

5) Explain the method of level measurement for open – to – atmosphere tank using differential pressure transmitter. Modify the same for closed tank. (2)

A)

i)

ii) Find the level of oil in the tank for the figure shown below. Given: h_m = 10mm, Z = $h_m/2$, P_a = 101.3 kPa, ρ_{oil} = 800kg/m^3, $\rho_{mercury}$ = 13600 kg/m^3. (2)



B) What is stroboscope? Explain its operation for measurement of speed. (3)

C) Describe with a neat sketch, the working principle of float operated voltage divider for level measurement. (3)

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