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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

**FOURTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.)**

**END SEMESTER DEGREE EXAMINATION, JUNE - 2019**

**SUBJECT: INDUSTRIAL INSTRUMENTATION [ICE 2202]**

TIME: 3 HOURS MAX. MARKS: 50

**Instructions to candidates :*Answer ALL questions and missing data may be suitably assumed.***

1A RTD has a resistance of 500Ω at 20°C and a temperature coefficient of 0.005 at 0°C. 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 when no self-heating of the RTD is considered.

1B Why is cold junction compensation required for a thermocouple? Explain with suitable diagram two method of implementation of the same.

1C Explain the construction and working of bimetallic thermometers.

(2+5+3)

2A A manometer uses transformer oil of specific gravity 0.864 as measuring liquid. The scale is graduated in mm of water. If one leg is having 2mm bore tube and other a 20mm well, calculate the angle to the horizontal at which the tube and scale must be inclined to give 4mm scale deflection for pressure of 1mm head of water. Assume 1mm of water = 9.81Pa.

2B With the help of a suitable circuit diagram, brief the working of a strain gauge transducer with a diaphragm element.

2C Describe the construction and working of Dead weight tester.

(2+4+4)

3A Explain the working principle of a vortex flowmeter with suitable diagram.

3B An Orifice meter is used to measure the volume flow rate of an oil having a density of 850 kg/m$^3$. Its diameter at the inlet and orifice are 0.3m and 0.2m respectively. The pressures at the upstream and downstream of the orifice are measured by pressure transducers and are found to be $1.8 \times 10^5$ Pa and $1.4 \times 10^5$ Pa respectively. The discharge coefficient of the Orifice is 0.62. Determine the volume flow rate of the oil.

3C Explain, with the help of a diagram, the principle of working of a rotameter. Derive the expression of mass flow rate for the same.

(2+3+5)

4A Discuss in detail the construction and working of a twin-turbine flowmeter with a suitable diagram.

4B Explain the method of level measurement to open – to – atmosphere tank using differential pressure transmitter. Modify the same for closed tank. Find the level of oil in the tank for the Fig. Q4B. Given: $h_m$ = 10mm, $Z = h_m/2$, $P_a$ = 101.3 kPa, $\rho_{oil}$ = 800kg/m$^3$, $\rho_{mercury}$ = 13600 kg/m$^3$.

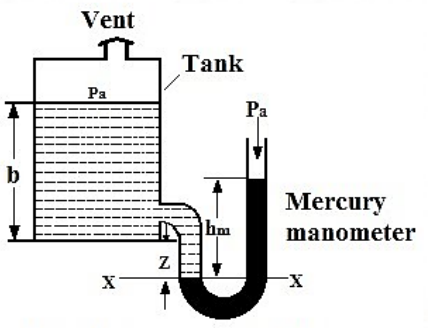

Fig. Q4B

4C Describe with a neat sketch, the working principle of float operated voltage divider for level measurement method.

(3+4+3)

5A Define Hygrometer. Describe psychrometer and explain its operation.

5B Write the working of falling ball viscometer. In a falling ball viscometer the ball attains terminal velocities of 0.01m/s for oil A and 0.002m/s for oil B. Assuming oils have the same density and oil A has a viscosity of $5x10^{-3}$ Ns/m$^2$. Find the viscosity of oil B in Ns/m$^2$.

5C Explain the measurement of speed using AC tachometer using a neat diagram.

(4+3+3)

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