Question Paper

Exam Date & Time: 28-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

IV Semester B. Tech Makeup Examanation, June 2024

INDUSTRIAL INSTRUMENTATION [ICE 2223]

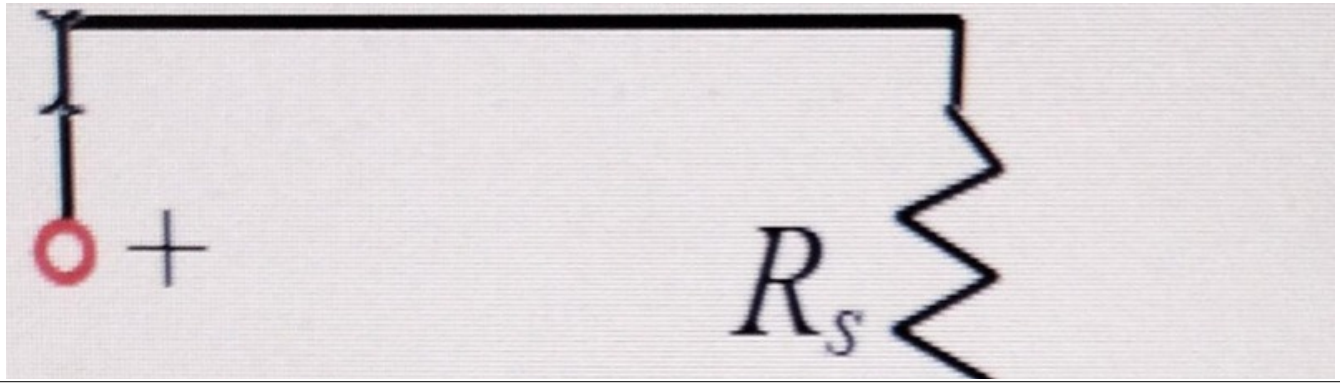
Marks: 50 **Duration: 180 mins.**

PART-A

Answer all the questions. Section Duration: 180 mins

Answer all Questions

1) A thermistor has a resistance of 16330 Ω at 0.0ºC, and it drops to 6247 Ω at 20.0ºC. This thermistor is used in a simple voltage divider circuit, as in Figure 1A. Consider V_s = supply voltage = 5.00 V DC and R_s = supply resistance = 10.00 KΩ. Calculate the output voltage at T = 0.0ºC. and output voltage at T = 20.0ºC. **[CO1, BL3, PO1, 2,3]** (3)



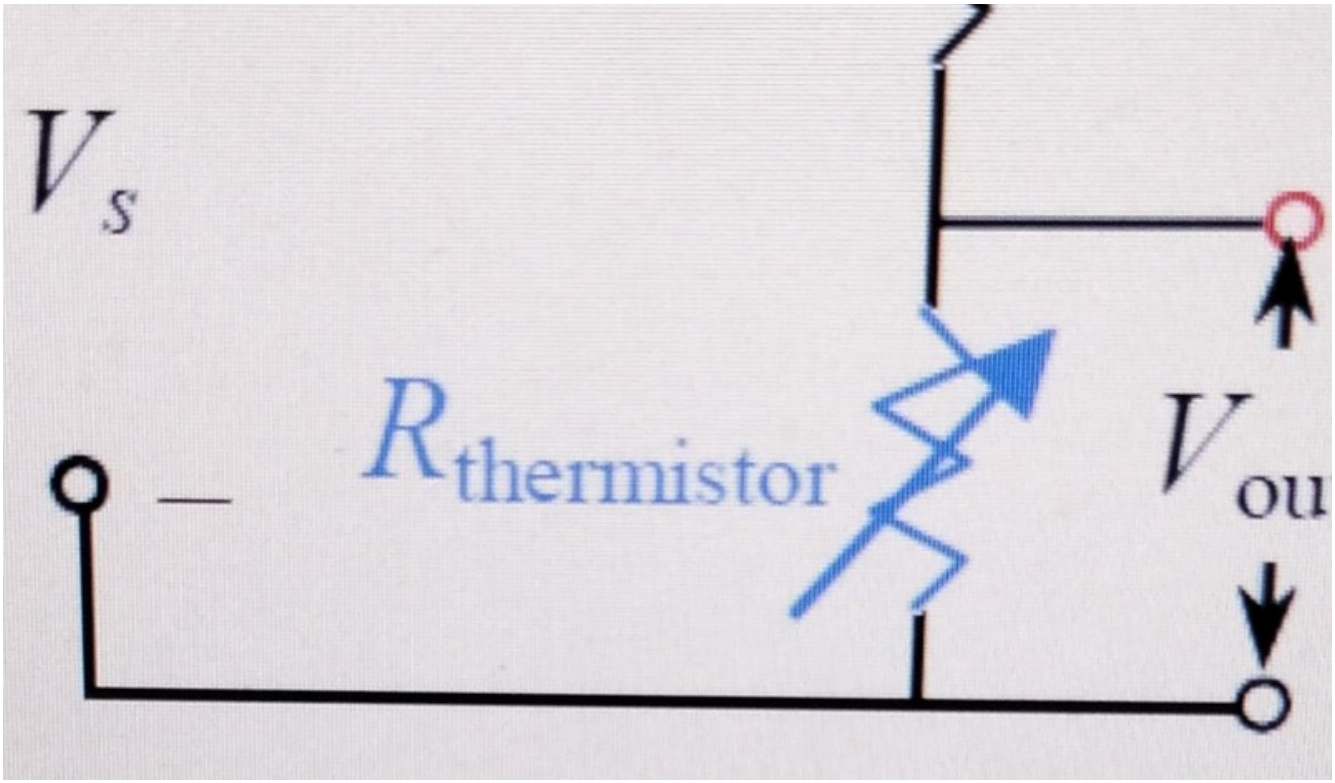


Figure 1A

2) Elucidate the mathematical basis of angular momentum based mass flowmeter. Illustrate the working mechanisms of Impeller turbine and Twin-turbine flow meters and analyze their suitability for viscous and slurry fluid samples. **[CO3, BL4, PO1, 2, 3, 4]** (5)

3) Interpret the reason behind the low flow cut-off behaviour observed in Vortex flowmeters. **[CO3, BL3, PO1, 2, 3]** (2)

4) With neat sketch, illustrate the working principle of Photoelectric tachometer and its advantages. **[CO4, BL2, PO1, 2, 3]** (4)

5) Mathematically determine the limiting conditions for use of a U tube manometer of length 38 cm and area of cross section 12 cm^2 for measurement of differential pressure across an orifice flowmeter. Arrive at expressions relating the measurement of level, pressure and hence flow in this particular case. **[CO2, BL3, PO1,2, 3, 4]** (4)

6) Illustrate briefly the use of bourdon tubes in measurement of fluid pressure in the tyres of a forklift. **[CO2, BL3, PO1,2, 3, 4]** (2)

7) Present a comparative analysis of the two different approaches in multi-phase flow measurement. With reference to three-phase flow made of oil, gas and water, justify the importance of flow homogenisation in reducing measurements. **[CO3, BL3, PO1, 2, 3,4]** (3)

8) With the help of suitable diagrams and expressions, illustrate the use of Pirani gauge in measurement of vacuum pressure **[CO2, BL3, PO1, 2, 3,4]** (4)

9) With the help of mathematical expressions, illustrate the transduction mechanism of differential pressure using strain gauge rosettes. **[CO2, BL3, PO1, 2, 3,4]** (3)

10) Interpret the importance of elemental analysis in multi-phase flow measurement. Illustrate with mathematical equations, the use of multi-energy gamma densitometer in elemental analysis. **[CO3, BL3, PO1,2,3,4]** (5)

11) How can the sag of a tied string be used to measure dive in submarines? Illustrate with suitable mathematical expressions. **[CO4, BL3, PO1,2, 3, 4]** (3)

12) While measuring speed of a steam turbine with stroboscope single line images were observed for stroboscope setting of 4000,5000 and 5230 r.p.m. Calculate the speed of the turbine. **[CO4, BL3, PO1,2, 3, 4]** (2)

13) Arrive at an expression for measurement of level of a cryogenic fluid in a spherical tank using (a) Differential pressure transducer and (b) load cell. What are the pertinent assumptions that you have made to arrive at these expressions? **[CO4, BL3, PO1,2, 3, 4]** (4)

14) A venturi meter is fitted in a pipe of 30 cm diameter, as shown in Figure 5B, inclined at 40° to the horizontal to measure the flow rate of petrol having a specific gravity of 0.8. The ratio of areas of main pipe and throat is 5 and the throat is at 1 m from the inlet along its length. The difference in manometer head is 40 mm of mercury. Assuming the coefficient of discharge as 0.96, compute the discharge through the venturi meter and the pressure difference between the throat and the entry point of the venturi meter. **[CO3, BL4, PO1,2, 3, 4]** (4)

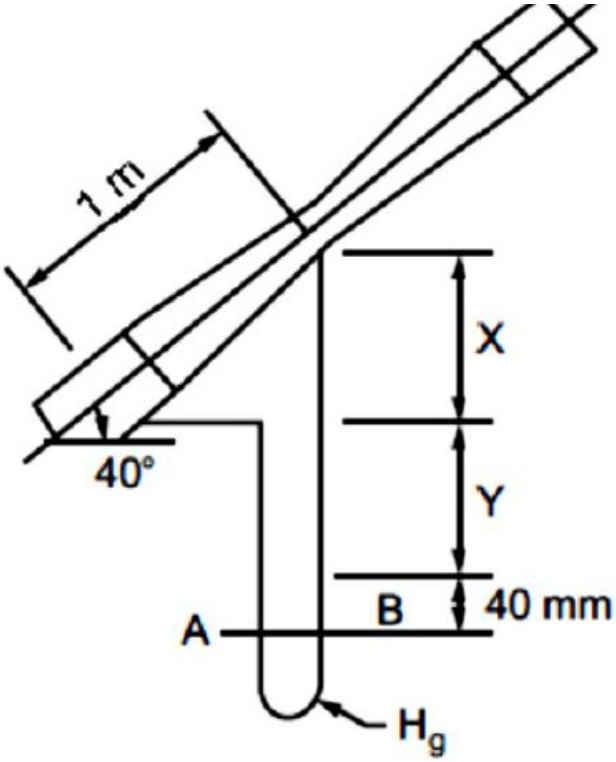


Figure 5B

15) Describe the safety considerations in measurement and storage of highly volatile fluids in industries **[CO5, BL2, PO1,2, 3, 4]** (2)

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