Exam Date & Time: 20-Jun-2022 (09:00 AM - 12:00 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, JUNE 2022 INDUSTRIAL INSTRUMENTATION [ICE 4303]

Marks: 50

A

Duration: 180 mins.

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

- 1) A platinum RTD is to be connected in a bridge arm as shown in the figure for measuring temperature of a colling bath. The bridge is balanced when the temperature of the bath is 0°C. Find out the temperature of the cooling bath when the balance detector reads a voltage
 - A) of 3V. Assume the RTD follows a linear temperature resistance characteristics. Temperature coefficient of resistance of Platinum =0.00385/°C



- B) Explain the construction and working of a bimetallic thermometer.
 - (3)
- C) Compare any two characteristics of a thermistor and a thermocouple. (2)

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| 2) | A) | A U tube manometer employs olive oil having a specific gravity of 0.82 as the manometer liquid. One limb of the manometer is exposed to atmosphere (740 mm Hg). The difference in column heights is measured as 20 cm when the other limb is exposed to an air source at a lower pressure. Calculate the air pressure in Pa. | |
|----|----|--|-----|
| | | Given: 1 atm = 101325 Pa. | (5) |
| | | Density of water =996 kg/m ³ | |
| | | Density of atmospheric air =1.15 kg/m ³ . | |
| | B) | Describe the principle and working of bourdon tube for pressure measurement. | (3) |
| | C) | A bellow used for pressure measurement has a LVDT connected as the secondary transducer. The sensitivity of the bellow and the LVDT is 3mm/Psi and 30mV/mm respectively. If the output range of the LVDT is -3V to 2V, Calculate range of pressure the bellow can measure. | (2) |
| 3) | | Explain the principle, construction and working of a orifice meter for flow measurement. | (5) |
| | A) | | |
| | B) | A horizontal venturimeter with inlet diameter 200mm and throat diameter 100mm is used to measure the flow of water. The reading of a differential pressure meter connected to it shows 0.72V. If the coefficient of discharge is 0.98 and the transfer characteristics of the differential pressure meter is 30mV/KPa , find out the flow rate in m ³ /s. | (3) |
| | C) | Describe the principle of a transit time Doppler flowmeter with supporting equations. | (2) |
| 4) | | Explain the principle, constructional detail and working of a electromagnetic flow meters . | (5) |
| | A) | | (3) |
| | B) | With a neat schematic, discuss the working of a handheld tachometer. | (3) |
| | C) | A float level transducer as shown is used to measure the level of water in a tank. The sensor is connected to one arm of a wheatstone bridge with the other arms as 100Ω , $1K\Omega$ and $1K\Omega$. If the bridge supply voltage is 12V, find out the output voltage range of the sensing | (2) |

system.



- 5) Compare and contrast the principle, constructional details and working of AC tachogenerator and DC tachogenerator. (5)
 - A)
 - B) Briefly describe the working of a stroboscope for angular velocity measurement. Discuss about the major errors that can be caused while using stroboscope. (3)
 - C) A strain gauge attached at the bottom is used for level measurement of liquid in a chamber. It has a GF=2.14 and a nominal resistance of 100Ω . Calculate the range of resistance change resulting from a strain of 110μ inch/inch to 180μ inch/inch, when the level increases (2) from minimum to maximum.

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