MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

MANIPAL

# FOURTH SEMESTER B.TECH. (INSTRUMENTATION AND CONTROL ENGG.) END SEMESTER DEGREE EXAMINATION, APRIL/MAY - 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 Describe the construction and working of thermocouples. State the thermo-electric laws.
- 1B Explain the working of radiation pyrometer.
- 1C For a certain NTC thermistor with  $\beta = 3100$  and resistance at 20°C is known to be 2300 $\Omega$ . What will be the temperature when the resistance is 1050 $\Omega$ .

(5+3+2)

2A A multi-tube manometer using air, water, mercury and gasoline is used to measure the pressure of gasoline in a vessel as shown in Fig. Q2A. Calculate the gauge pressure in the gasoline vessel.



Fig. Q2A

- 2B With a neat diagrams, explain the working of bellows for measurement of absolute pressure, gauge pressure and differential pressure.
- 2C Describe the construction and working of Pirani gauge.

(4+3+3)

- 3A Briefly discuss with a neat sketch, how the flow rate of liquids can be measured using magnetic flowmeters. Derive the expression for its volumetric flow rate.
- 3B A Venturi tube of throat diameter 6cm is placed in a water pipe of diameter 10cm to measure the volumetric flow rate which is found to be  $0.08m^3/s$ . If the density and viscosity of water are  $10^3 \text{ kg/m}^3$  and  $10^{-3}$  Pa.s respectively, determine
  - a. Reynolds number.
  - b. Upstream-to-downstream differential pressure developed. (Given: Discharge coefficient = 0.99)
- 3C With suitable circuit diagram, explain the working of a Coriolis flowmeter.

(3+3+4)

4A Multiphase flow is formed by mixing water, oil and gas. Explain the different ways of measuring flow rate of the mixture.

- 4B Write the principle and working of a level measurement system using capacitive transducer for conducting and non-conducting liquid.
- 4C The float of a system shown in Fig. Q4C is used to measure the level of liquids having a maximum density of 1200 kg/m<sup>3</sup>. Its diameter is 0.3m and the maximum depth of immersion is 1.5m, with no cover on top of the float. Calculate the range of force exerted on the suspension point if the float has a mass of 150 kg.



## Fig. Q4C

(3+5+2)

- 5A Acetic acid of density 1050 kg/m<sup>3</sup> was passed through a tube of bore 1mm and 300mm long under a head of 200mm. A quantity of 50x10<sup>3</sup> mm<sup>3</sup> was found to flow in 520 seconds. Calculate the dynamic viscosity of acid and also find whether the flow is laminar or not.
- 5B Describe how relative humidity can be determined using dew point temperatures.
- 5C What is stroboscope? Explain its operation for measurement of speed.

(3+4+3)

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