Printed Pages : 3 **EIC502**

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2122 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. V) THEORY EXAMINATION, 2012-13

INDUSTRIAL INSTRUMENTATION

Time : 3 Hours] *[Total Marks : 100*

SECTION – A

1. Attempt **all** question parts : **10 × 2 = 20**

(a) A capacitive transducer consists of two plates of diameter 2 cm each, separated by an air gab of 0.25 mm. Find the displacement sensitivity.

(b) Specify the main drawbacks of McLead gage.

(c) State the intermediate metals law in thermocouple.

(d) Mention some applications of bimetallic thermometer.

(e) State the principle of ultrasonic flow meter.

(f) The variable area is used in rotameter. Give the reason.

(g) Write down the formula of Saybolt viscometer.

(h) List out the advantages of null balance method.

(i) What is the need for the measurement of moisture ?

(j) Specify the application of Humistor.

SECTION – B

2. Attempt any **three** question parts : **10 × 3 = 30**

(a) (i) Enlist the various types of strain gauges and explain any one of them.

(ii) Give the working principle of LVDT with a neat sketch.

(b) A 500 resistance thermometer carries 5-mA current. Its surface area is 0.5 in^2, and it is immersed in stagnant air, so that the heat transfer coefficient is U = 1.5 Btu/(h.ft^2.f°). Find its self heating error. What would be error in water with U = 100 Btu/(h.ft^2.f°) ?

(c) What is manometer ? Enlist the different type of manometer and explain inclined type manometer with proper diagram.
A manometer has a well of 18 mm in diameter and a tube of 3 mm of inner bore. It is proposed to use a scale graduated accurately in mm to measure the pressure directly i.e. 1 mm scale division indicates a 1 mm pressure head change. Calculate the angle at which the tube must be inclined to vertical to do this. Density of mercury is 13.56*10^3 kg/m^3. Assume 1 mm of Hg = 133 N/m^2.

(d) What is humidity measurement ? Explain about distillation method. Write its merits and demerits.

(e) A pitot tube is used to measure flow velocity in water of density 1000 kg/m^3.
(i) Determine the flow velocity at the head of pitot tube if it produces differential pressure of 10 kN/m^2 between its two outlets.
(ii) The same differential pressure is obtained in air at altitude where the density of air is 0.65 kg/m^3. Determine the velocity of air.

SECTION – C

Attempt **all** question : **10 × 5 = 50**

3. Attempt any **two** parts : **(5 × 2 = 10)**

(a) A U-tube manometer is used to measure a differential air pressure with a fluid of density 400 Kg/m. The air is at 280 kPa and 27 °C. Calculate the differential pressure if the difference in the height of the fluid in the manometer is 110 mm. Express in units of kPa.

(b) Illustrate about the construction of resistance thermometer (pirani) gage where the functions of heating and temperature measurement are combined in a single element.

(c) A piezo-electric transducer has the following characteristics :

Capacitance of crystal = 10^{-9} F

Capacitance of cable = 3×10^{-10} F

Charge constant of crystal = 4×10^{-6} C/cm

The oscilloscope used for read-out has a resistance of 1M in parallel with a capacitance of 10^{-10} F. Find the amplitude of the output voltage, as displayed on the oscilloscope, if the crystal is subjected to a harmonic deformation of amplitude 10^{-3} mm and frequency 200 Hz.

4. Attempt any **one** part : **(1 × 10 = 10)**

(a) A power radiated from a hot piece of metal was measured by radiation pyrometer and the temp was determined as 80 °C. Assuming the surface of emissivity of 0.70 later it was found that the accurate volume of emissivity was 0.65. Find the error in temperature determination.

(b) Enlist the different types of thermal expansion methods. Explain any one of them with a neat sketch.

5. Attempt any **one** part : **(1 × 10 = 10)**

(a) Water (density: 1000 kgm^{-3}) stored in a cylindrical drum of diameter 1 m is emptied through a horizontal pipe of diameter 0.08 m. A pitot-static tube is placed inside the pipe facing the flow. At the time when the difference between the stagnation and static pressure measured by the pitot-static tube is 9KPa. Find the rate of reduction in water level in the drum.

(b) Elaborate the working principle of rotameter with a neat sketch.

6. Attempt any **one** part : **(1 × 10 = 10)**

(a) How load cell method is used for weight measurement ? Explain the working of hydraulic load cell with neat diagram.

(b) Name some of the piezoelectric crystals. Discuss about the piezoelectric transducer for weight measurement.

7. Attempt any **two** parts : **(5 × 2 = 10)**

(a) Write short notes on the thermal dying method.

(b) Describe about the electrical method of moisture measurement.

(c) Elucidate about the chemical reaction method for the measurement of moisture.
