OR

[Experimental Techniques]

Full Marks : 40   Time : Two Hours

Group - A

1. Answer any *five* of the following questions.   2×5=10
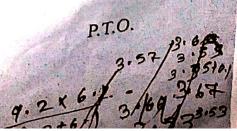
   (i) Count the total number of significant figures in the following measurements :

   (a) 0.0500   (b) 2400

   (c) 9500   (d) 5.70×10^5

   (ii) Round off the following numbers to three significant figures :

   (a) 24.937   (b) 36.350

   (c) 42.450×10^9 (d) 742396

   (iii). The mass and density of a solid sphere are measured to be (12.4 ± 0.1)kg and (4.6 ± 0.2)kg/m³. Calculate the volume of the sphere with error limits.

   (iv) Calculate equivalent resistance with error limit of two resistors R_1 and R_2 in parallel, where $R_1 = (9 \pm 0.2)\Omega$ and $R_2 = (6 \pm 0.1)\Omega$.

   (v) Write down the working pressure ranges of Rotary pump, Diffusion pump, Pirani gauge and Penning gauge.

P.T.O.

(vi) What do you mean by noise figure?

(vii) What is thermal noise?

(viii) Write two differences between analog and digital instruments.

Group - B

Answer any *four* of the following questions :

$5 \times 4 = 20$

2. The diameter of a wire as measured by a screw gauge in a number of measurements was found to be 2.620, 2.625, 2.630, 2.628 and 2.626 cm.

   Calculate (i) mean value of diameter (rounding off to three decimal places) (ii) mean absolute error (iii) fractional error and (iv) percentage error. 5

3. Write down the properties of transfer functions of an instrument. What do you mean by the zero-order instrument? Give two examples of it. 2+2+1=5

4. A rotary pump removes air from a 300-litre chamber at the rate of 0.5 litre/sec. What would be the pressure in the chamber after 20 sec if the initial pressure were 1 atm. 5

5. Write down the two methods for measurement of linear displacement using capacitive transducer. 2½+2½=5

6. What is Q meter? Write its uses. 3+2

7. What are periodic and non-periodic signals? Determine whether the signal $x(t) = [\cos(2\pi t)]^2$ is periodic or not. If periodic, find the fundamental period. 2+3

Group - C

Answer any *one* of the following questions :

10×=10

8. (a) Define Gauge factor (G) of a strain gauge. Derive the expression,

$$G = 1 + 2\sigma + \frac{\Delta\rho/\rho}{\Delta l/l}, \text{ where, } \sigma \text{ is the Poisson's ratio}$$

and ρ is the resistivity of the wire.

(b) Write down the working principle of a metallic strain gauge and a semiconductor type strain gauge. 1+4+2½+2½=10

9. What is transducer? Write the working principle of a Linear Variable Differential Transformer (LVDT). How does a scintillation detector work? What are the different temperature transducers? 2+4+2+2

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