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BME-014

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00312 **Term-End Examination**

December, 2014

BME-014 : METROLOGY AND INSTRUMENTATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. Use of scientific calculator is permitted. Assume missing data suitably, if any.*

1. (a) Differentiate between primary and secondary standards. 3

(b) What are the SI units of the following quantities : 2

Resistance, Inductance, Capacitance and Current.

(c) The thermal conductivity of a metal is 0·3 cal/cm-s-°C. Find its value in SI units. 5

2. (a) Differentiate between systematic and random errors. *4*

(b) A certain obstruction-type flow meter is used to measure the flow of air at low velocities. The relation describing the flow rate is

$$m = CA\left[\frac{2p_1}{RT_1}(p_1 - p_2)\right]^{1/2}$$

where C is an empirical discharge coefficient, A is the flow area, p_1 and p_2 are the upstream and downstream pressures, T_1 is the upstream temperature and R is the gas constant for air.

Calculate the relative uncertainty in the mass flow rate for the following conditions :

$C = 0{\cdot}92 \pm 0{\cdot}005$ (from calibration data)

$p_1 = 25 \pm 0{\cdot}5$ psia

$T_1 = 530 \pm 2°$ R

$\Delta p = p_1 - p_2 = 1{\cdot}4 \pm 0{\cdot}005$ psia

$A = 1{\cdot}0 \pm 0{\cdot}001\ m^2$ *6*

3. List the essential parts of Vernier Height Gauge. Explain its working with a neat sketch. *10*

4. Discuss the unilateral and bilateral systems of writing tolerances with suitable examples and explain which system is preferred in interchangeable manufacturing and why. *10*

5. List out the commonly used gauges in production work. Illustrate the applications of any two with a neat sketch. *10*

6. Describe the working principle, construction and advantages of optical comparator. *10*

7. (a) What are angle gauges ? Explain with suitable examples how these are used for measuring angles. *6*

   (b) Mention the specific applications of angle gauges. *4*

8. (a) Explain the working principle of Tool marker's microscope. *6*

   (b) Discuss its various applications. *4*

9. Give brief description about important parts of a Co-ordinate Measuring Machine (CMM). *10*

10. What do you mean by the term 'interferometer' ? What are their advantages over optical flats ? *10*
