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BME-014

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

01468

Term-End Examination

June, 2014

BME-014 : METROLOGY AND INSTRUMENTATION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) What are the standards of measurement and their classification ? *4*

(b) Write the SI units of the following : *4*

(i) Temperature

(ii) Current

(iii) Luminous intensity of light

(iv) Force

(c) Derive a factor to convert density from g/cm^3 to kg/m^3. *2*

(d) Why are Standards necessary ? What are standard units of electrical quantities ? *4*

2. (a) Define the following with suitable examples : *6*

(i) Gross errors

(ii) Systematic errors

(iii) Random errors

(b) The resistance of a certain size of wire is given by,

$$R = R_0[1 + \alpha(T - 20)]$$

where R_0 = 6 Ω ± 0·3 percent is the resistance at 20°C

α = 0·004°C ± 1 percent is the temperature coefficient of resistance, and

T = 30 ± 1°C is the temperature of the wire.

Find its uncertainty. *8*

3. (a) Explain the following terms with the help of neat diagram : *3*

(i) Clearance fit

(ii) Transition fit

(iii) Interference fit

(b) Explain hole basis and shaft basis system of fit with the help of diagrams. *5*

(c) Define tolerance. What are unilateral and bilateral tolerances ? Find the type of fit for a pair of shafts defined as follows : *6*

shaft dia : $100^{+0.055}_{+0.050}$

hole dia : $100^{+0.050}_{-0.025}$

4. (a) What are the differences between standard gauges and limt gauges ? *4*

(b) Name the gauges to be used for following : *4*

(i) Nut

(ii) Bolt

(iii) Hole

(iv) Wire

(c) Sketch and describe the following : *6*

(i) Taper Gauges

(ii) Snap Gauges

5. (a) The following readings are taken of a certain physical length. Compute the mean reading, standard deviation and variance. *9*

Reading	1	2	3	4	5	6	7	8	9	10
x_i (cm)	5·3	5·73	6·77	5·26	4·33	5·45	6·09	5·64	5·81	5·75

(b) Define the following terms : 5

(i) Arithmetic mean

(ii) Median

(iii) Mode

(iv) Geometric mean

(v) Harmonic mean

6. (a) Describe the following firm joint calipers with neat sketches : 7

(i) Outside caliper

(ii) Inside caliper

(b) List various types of micrometers. Describe inside micrometer with the help of sketch. 7

7. (a) What are the different types of comparators ? Explain the optical comparators in brief. 7

(b) What is a sine bar ? How is it used to measure an angle between two surfaces ? Could you measure all angles with this arrangement ? 7

8. (a) Describe the working principle of an autocollimator with suitable sketches. 9

(b) Describe the different parts of a coordinate measuring machine. 5