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BME-014

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00572

Term-End Examination

December, 2016

BME-014 : METROLOGY AND INSTRUMENTATION

Time : 3 hours *Maximum Marks : 70*

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

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1. (a) Why are tolerances provided on dimensions of the components ?

(b) Explain each type of fit with suitable examples. *5+5*

2. (a) Explain the following terms in mechanical measurements :

(i) Calibration

(ii) Sensitivity

(iii) Precision

(iv) Accuracy

(v) Errors

(b) The diameter of a steel ball is measured five times with a micrometer, giving the following results :

8·011 mm, 8·005 mm, 8·009 mm, 8·014 mm, 8·011 mm

Calculate the mean diameter and standard deviation. *5+5*

3. (a) The divisions on the main scale of a vernier caliper are 0·5 mm apart. The vernier has 100 divisions equal in length to 98 main scale divisions. To what accuracy can the instrument read ?

(b) What are the SI units of the following quantities ?

(i) Resistance

(ii) Inductance

(iii) Capacitance

(iv) Current

(v) Luminous Intensity $7\frac{1}{2}+2\frac{1}{2}$

4. (a) Explain the purpose of comparator as used in engineering measurement. What are the advantages offered by the use of comparators when making precision linear checks ? Explain with examples.

(b) A 200 mm sine bar is to be set to an angle of 32°5′6″. Find the length of the gauge blocks required using any appropriate set of gauge blocks. *5+5*

5. (a) Explain why it is not preferred to use a sine bar for generating angles larger than 45°, if high accuracy in angle generation is required.

(b) In a hole and shaft combination of 25 mm the nominal size H7 hole limits are $\begin{matrix}+0{\cdot}021 \text{ mm} \\ +0{\cdot}000 \text{ mm}\end{matrix}$ and shaft limits are $\begin{matrix}-0{\cdot}040 \text{ mm} \\ -0{\cdot}073 \text{ mm}\end{matrix}$. State the values of

(i) maximum and minimum clearance obtainable,

(ii) allowance, and

(iii) tolerance on the hole and the shaft. *5+5*

6. (a) Distinguish between a measuring instrument and a gauge.

(b) Explain the terms 'primary texture' and 'secondary texture'. *5+5*

7. (a) Name any two mechanical comparators and mention why there are no wear-related errors in these instruments.

(b) What are the main disadvantages of optical comparators ? Discuss in detail. *5+5*

8. (a) Explain in brief the working principle of an optical micrometer along with two industrial applications.

(b) The total tolerance on a 60 mm hole is 150 microns. Determine the maximum and minimum size of this hole with the help of neat sketches. *7+3*

9. (a) Define the terms allowance and clearance with suitable examples.

(b) What points will you keep in mind in selecting the tolerance between the piston and cylinder of a steam engine ? Support your answer with reason and diagram. *5+5*

10. (a) What are the slip gauges ? How are they used with sine bar ? Discuss in detail.

(b) Discuss any two types of limit gauges with the applications. *5+5*
