No. of Printed Pages : 5 **BME-014**

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2011

BME-014 : METROLOGY AND INSTRUMENTATION

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** from the following questions. Use of calculator is allowed.*

1. (a) What is a coordinate measuring machine and what advantages does it offer in measuring various manufactured parts. **5+5**

   (b) Two closely placed light sources emit light waves of same angular frequency but different phase angles. Write down equation for two waves. On reaching a point at a distance D from the sources the two waves are superimposed. Find the resultant wave.

2. (a) What is a comparator ? State different type of comparator. Compare mechanical comparator with electrical comparator. **5+5**

(b) Why is it necessary to give a tolerance on an engineering dimension ? Give an example of both the bilateral and unilateral tolerances.

3. (a) A bore is to be made 500.10 mm in diameter, with a tolerance of ± 0.02 mm and for checking it, a pin gauge 500.00 ± 0.01 mm long is supplied. Determine the limits on the total movement of the free end. **5+5**

(b) A calibrated meter end bar has an actual length of 1000.0005 mm. It is to be used in the calibration of two bars, A and B each having a basic length of 500 mm. When compared with the metre bar L_A and L_B was found to be shorter by 0.0003 mm. In comparing A with B, it was found that A was 0.0006 mm longer than B. Find the actual length of A and B.

4. (a) A taper ring gauge has a mean dia. of 17.5 mm and an axial length of 32.5 mm. Describe how you would find the angle of the taper. Show all necessary calculations. **5+5**

(b) It is possible to drill a 25 mm nominal hole to an accuracy of $25^{+0.02}_{-0.02}$ mm using standard drill and drilling machine available. A shaft is to be machined to obtain a clearance fit in above hole such that allowance should be 0.01 mm and maximum clearance should not be more than 0.08 mm. What should be the tolerance on the shaft ?

5. (a) In Young's double slit experiment the slits are separated by 0.28 mm and the screen is placed 1.4 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm, determine the wavelength of light used in the experiment. 5+5

(b) Cold drawn shafts upto accuracy of ± 0.01 mm. are available and an interference fit is to be designed for a 50 mm nominal size hole. Determine the tolerance for hole if maximum and minimum interferences are to be 0.01 mm and 0.07 mm respectively.

6. (a) Discuss the different allowances that must be taken into account in the manufacture of a gauge. 5+5

(b) What is tool-maker's microscope ? Give more typical applications of its use.

7. (a) In a modern engineering work, component parts are manufactured from dimensioned drawings. A feature of the Method is that same sizes are shown as follows : **5+5**

50.03 When the normal size is

49.97 50 mm hole basis.

Explain why this procedure is adopted.

(b) Determine the actual dimensions to be provided for a shaft and hole of 90 mm size for H_8e_9. type clearance fit. Size 90 mm falls in diameter steps of 80 and 100

value of tolerance unit :

$$i = 0.45\left(\sqrt[3]{D}\right) + 0.001D$$

Value of tolerances for IT8 and IT9 grades are $25i$ and $40i$. Value of fundamental deviation for 'e' type shaft is $-11D^{0.41}$.

8. (a) When inspecting cylindrical work a ring gauge or a gap gauge may be employed. Explain the advantages of using both types. **5+5**

(b) A 50 mm diameter shaft is made to rotate in the bust. The tolerance for both shaft and bust are 0.050 mm. Determine the dimension of the shaft and bust to give a maximum clearance of 0.0075 mm with the hole basis system.

9. (a) What are the necessary conditions for interference of light waves ? 5+5

(b) In a hole and shaft combination of 25 mm nominal size.

H_7 hole limit are $+0.021$ mm, $+0.000$ mm e_8 shaft limit are -0.040, -0.073 mm state the values of :

(i) maximum and minimum clearance obtainable.

(ii) allowance.

(iii) tolerance on the hole and the shaft.

(iv) type of fit.

10. (a) What are important characteristics of dial indicator ? Enumerate its uses. 5+5

(b) Describe the precautions that should be taken to prevent corrosion of highly finished surfaces.