

**III B.Tech. II Semester Regular Examinations, April/May -2005****METROLOGY****(Mechanical Engineering)****Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) Draw a conventional diagram for explicit representation of all types of fits of hole based system, with lower deviation of hole coinciding with zero line. Indicate all the basic terms of fits on the same diagram.  
(b) A 20mm diameter shaft and bearing are to be assembled with a clearance fit. The tolerance and allowances are as under:  
Allowance = 0.002mm  
Tolerance on hole = 0.005mm  
Tolerance on shaft = 0.003mm  
Find the limits of size for the hole and shaft if:  
i. the hole basis system is used  
ii. shaft basis system is used.  
The tolerances are disposed of unilaterally.
2. (a) What are different grades of slip gauges as per IS:2984-1966  
(b) Describe the special construction features of dial test indicators.
3. Explicate the use of  
(a) angle gauges  
(b) sine bars for measurement of angles
4. (a) Explicate  
i. profile gauge  
ii. plug gauge with sketches  
(b) Design and sketch the limit gauges to control the production of shaft and hole pair designated by  $50 H_7 d_{10}$ . The specifications of the fit are  $50H_7 = 50^{+0.025}_{+0.000}$  and  $50d_{10} = 50^{-0.080}_{-0.000}$
5. Enumerate various optical projectors. Explain the working principle of the optical system of a projector, with the help of neat sketch.
6. (a) What are various orders of geometrical irregularities on surfaces ? How these are classified ?  
(b) Describe with a neat sketch the construction , principle and operation of Tomlinson surface meter.

7. (a) Explain how the principle of visual gauging heads is incorporated in multi gauging machines.  
(b) Enumerate the various equipments and their essential precision and accuracy levels for performing alignment tests.
8. (a) Describe an exclusive method for effective diameter measurement which shows variation in drunken thread.  
(b) Explicate gear metrology of spur gears with reference to
  - i. Lead
  - ii. profile

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1. (a) Identify whether the following fits are hole-based or shaft-based. Convert them in to equivalent other systems.
  - i.  $H_7 - c_8$
  - ii.  $J_6 - h_5$
  - iii.  $H_6 - n_5$
- (b) Determine and sketch the limits of tolerance and allowance for a 25mm shaft and hole pair designated  $H_7 - f_8$ . The basic size lies in the range of 18-30mm. The multipliers for grades 7 and 8 are 16 and 25 respectively. The fundamental deviation for 'f' shaft is  $(-5.5 D^{0.41})$  microns.
2. (a) Describe with a neat sketch the working of an outside micrometer to an accuracy of 0.001mm
- (b) Explain terms line standards and end standards with examples
3. (a) Explicate reasons for not-to- use sine bar for measuring angles more than  $45^\circ$ .
- (b) The angle of wedge shaped block is being checked with 300mm Sine bar. With slip gauges of 25.857mm height at one end of Sine bar, the dial gauge readings at each end of the work piece vary by 0.04mm, the gauge block end being low. If the work piece is 34mm long what should be the next height of the gauge block tried ? Also calculate the angle of the work piece?
4. (a) State the Taylor's principle of gauge design .
- (b) Design general type GO and NO-GO gauges for components having 55 H8/d9 fit. The basic size falls in the diameter range of 50-80mm. The fundamental deviation for 'd' shaft= $(-16 D^{0.41})$  microns. The multipliers for 8 and 9 grades are 25 and 40. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values.
5. Elucidate the working principles of
  - (a) Autocollimator
  - (b) Optical projector
  - (c) Straight edge
6. Describe various methods of numerical assessment of surface finish

7. (a) What are the advantages, uses and disadvantages of electrical comparators.  
(b) Explain the following alignment tests on lathe:
  - i. True running of locating cylinder of main spindle.
  - ii. True running of taper socket in main spindle.
8. Describe the pitch measurement of internal and external screw threads by various methods.

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1. (a) Identify whether the following fits are hole-based or shaft-based. Convert them in to equivalent other systems.
  - i.  $H_{11} - d_{11}$
  - ii.  $H_{11} - d_{11}$
  - iii.  $T_7 - h_6$
- (b) Determine and sketch the limits of tolerance and allowance for a 90mm shaft and hole pair designated  $H_8 - e_9$ . The basic size lies in the range of 80-100mm. The multipliers for grades 8 and 9 are 25 and 40 respectively. The fundamental deviation for 'e' shaft is  $(-11 D^{0.41})$  microns.
2. (a) Explain the occurrence of cumulative and progressive errors in micrometers
- (b) Describe the working principle of dial indicator with gear and pinion mechanism.
3. Discuss various methods of taper measurement of plug and ring gauges
4. (a) Explicate the classification of plain limit gauges
- (b) Design general type GO and NO-GO gauges for components having 25 H8/f9 fit. The basic size falls in the diameter range of 18-30mm. The fundamental deviation for 'f' shaft= $(-5.5 D^{0.4})$  microns. The multipliers for 8 and 9 grades are 25 and 40. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values.
5. (a) Describe the working principle of tool markers microscope. What are its uses
- (b) Explicate the utility of straight edge and surface plate in laboratories.
6. (a) Describe the measurement of surface roughness by optical and mechanical means of magnification.
- (b) The heights of peaks and valleys of 20 successive points on a surface are 35, 25, 40, 22, 37, 19, 41, 21, 42, 18, 42, 24, 44, 25, 40, 18, 40, 18, 39, 21, microns respectively, measured over a length 20 mm, Determine CLA and RMS values of roughness surface
7. (a) What are the advantages and disadvantages of mechanical comparators.
- (b) Explain the working principle of mechanical-optical comparator
8. (a) Enumerate various screw thread parameters for metrological measurement. Also enlist instruments corresponding to their measurements.

- (b) Describe with the help of a neat sketch the working of “Gear tooth vernier caliper”.

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1. (a) Explicate the classification of various fit. Also provide on a single diagram, The explicit representation of all fits with common zero line.  
(b) A hole and mating shaft are to have a nominal assembly size a minimum assembly size of 50mm. The assembly is to have a maximum clearance of 0.15mm and a minimum clearance of 0.05mm. The hole tolerance is 1.5 times the shaft tolerance. Determine the limits for both hole and shaft: by using
  - i. Hole basis system
  - ii. Shaft basis system.
2. (a) Explicate with a neat sketch the working principle of “Differential screw micrometer”  
(b) What are end standards? Explain with examples, the characteristics of end standards
3. Discuss various methods of taper measurement of plug and ring gauges
4. (a) Sketch a double ended plug gauge and progressive plug gauge. What are the advantage and disadvantages of one over the other ?  
(b) Design and sketch a working gauge with a GO and NO-GO ends for spindle  $\frac{30.980}{30.960}$  mm and a hole of  $\frac{31.023}{31.000}$  mm
5. (a) Describe the working principle of tool markers microscope. What are its uses  
(b) Explicate the utility of straight edge and surface plate in laboratories.
6. (a) Differentiate between surface roughness and waviness.  
(b) What are different methods of surface finish measurement with reference to inspection by comparison.
7. (a) Explain how the principle of visual gauging heads is incorporated in multi gauging machines.  
(b) Enumerate the various equipments and their essential precision and accuracy levels for performing alignment tests.
8. (a) What is “ Best size wire” for effective diameter measurement ? Derive a relationship for the best size wire in terms of its effective diameter.  
(b) Explicate gear metrology of spur gears with reference to
  - i. Concentricity

ii. alignment

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