

III B.Tech II Semester Supplementary Examinations, Apr/May 2008
METROLOGY

(Mechanical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Explain the terms: Basic size; Zero line; lower and upper deviations. Draw a conventional diagram to represent these terms for a shaft and hole pair of interference fit.
(b) The hole and shaft assembly of 30mm nominal size have tolerances specified as $30^{+0.02}_{-0.000}$ mm for hole and $30^{-0.04}_{-0.07}$ mm for shaft. Determine
 - i. Maximum and minimum clearance (interference) attainable
 - ii. Allowance
 - iii. Hole and shaft tolerances
 - iv. Fundamental deviation
 - v. MML for shaft and hole
 - vi. Type of fit.Sketch these values on a conventional diagram. [8+8]
2. (a) Describe the linear measurements with
 - i. Depth micrometer
 - ii. Telescopic gauge(b) What are wavelength standards and what are their advantages? [8+8]
3. Discuss various methods of taper measurement of plug and ring gauges. [16]
4. (a) Explicate plain and tapered plug gauges for tapers, with sketches
(b) Design and sketch a working gauge with a GO and NO-GO ends for spindle $\frac{55.006}{55.000}$ mm and a hole of $\frac{54.980}{54.800}$ mm. [6+10]
5. (a) Explicate the working principle of an Autocollimator.
(b) Explicate the use of interferometer in measuring flatness of surfaces. [8+8]
6. (a) Explain terms: Roughness height; Roughness width; Lay; flaw
(b) Describe evaluation of roughness by
 - i. Ten point Height method
 - ii. CLA method[8+8]
7. (a) Differentiate between measuring instrument and comparator.
(b) Enumerate various equipment desirable for alignment tests on lathe. Enlist various such tests for lathe. [6+10]

8. (a) Explicate the measurement of effective diameter using
- i. thread micrometer
 - ii. one wire method.
- (b) Analyze gear metrology of
- i. Run out
 - ii. back lash.

[8+8]

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1. (a) Define terms: Basic hole; Basic shaft ; Tolerance zone; Tolerance grade. Draw a conventional diagram of shaft and hole pair for explicit representation of these terms.
(b) The hole and shaft assembly of 60mm nominal size have tolerances specified as $60^{+0.04}_{-0.00}$ mm for hole and $60^{+0.06}_{+0.04}$ mm for shaft. Determine
 - i. Maximum and minimum clearance (interference) attainable
 - ii. Allowance
 - iii. Hole and shaft tolerances
 - iv. Fundamental deviation
 - v. MML for shaft and hole
 - vi. Type of fit.Sketch these values on a conventional diagram. [8+8]
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. [10+6]
3. Discuss various methods of taper measurement of plug and ring gauges. [16]
4. (a) Differentiate between workshop gauges and inspection gauges.
(b) Design general type GO and NO-GO gauges for components having 45 H7/g8 fit. The basic size falls in the diameter range of 30-50mm. The fundamental deviation for ‘g’ shaft= $(-2.5 D^{0.34})$ microns. The multipliers for 7 and 8 grades are 16 and 25. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values. [6+10]
5. What are the numerous fringe contours in checking slip gauges by means of optical flats? Describe the method of experimental testing of such surfaces. [16]
6. (a) What are the factors affecting surface roughness? What is the necessity for controlling the surface texture?
(b) Explicate the details of construction, principle and operation of stylus. [8+8]
7. (a) Elucidate with a neat sketch the working principle of electrical comparators.
(b) What are the various machine tool tests common to most of machine tools. [8+8]

8. (a) “ Measurement of effective diameter by three wires is more accurate than any other method” - Explain.
- (b) State various sources of errors in manufacture of gears. [8+8]

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1. (a) Explain terms : Interchangeability and selective assembly. Enumerate the differences between them.
(b) Determine and sketch the limits of tolerance and allowance for a 25mm shaft and hole pair designated $H_8 - d_9$. The basic size lies in the range of 18-30mm. The multipliers for grades 8 and 9 are 25 and 40 respectively. The fundamental deviation for 'd' shaft is $(-16 D^{0.44})$ microns. [8+8]
2. (a) Describe the selection of minimum number of slip gauges for a dimension of 29.759mm from M112 set. What care of slip gauges is essential ?
(b) Describe the working principle and uses of Lever type dial test indicator. [8+8]
3. Explicate the use of
(a) angle gauges
(b) sine bars for measurement of angles [8+8]
4. (a) Elucidate terms : gauges tolerance and wear allowance as assignable to limit gauges.
(b) Design general type GO and NO-GO gauges for components having 65 H7/m6 fit. The basic size falls in the diameter range of 50-80mm. The fundamental deviation for 'm' shaft = $(IT_7 - IT_6)$ microns. The multipliers for 7 and 6 grades are 16 and 10. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values. [6+10]
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. [10+6]
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. [8+8]
7. (a) Elucidate the working principle of sigma comparator with a neat sketch.
(b) What are the advantages and disadvantages of sigma comparator. [10+6]

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
- [8+8]

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 - i. Maximum and minimum clearance (interference) attainable
 - ii. Allowance
 - iii. Hole and shaft tolerances
 - iv. Fundamental deviation
 - v. MML for shaft and hole
 - vi. Type of fit.Sketch these values on a conventional diagram. [8+8]
2. (a) Enumerate various types of outside micrometers and their uses.
(b) What are line standards? Explain with examples, the characteristics of line standards. [10+6]
3. Discuss various methods of taper measurement of plug and ring gauges. [16]
4. (a) Explicate
 - i. plain ring gauges
 - ii. plate snap gauges with sketches(b) Design and sketch suitable GO and NO-GO plug gauges of 'progressive type' for checking a bored hole of $\frac{35.020}{35.001}$ mm diameter. [6+10]
5. Describe the working principle of NPL Flatness interferometer with a sketch. What are the fringe patterns obtainable in case of tapered surfaces. [16]
6. (a) Enumerate various direct instrument methods for measurement of surface finish.
(b) Describe surface measurement with inspection by comparison methods. [6+10]
7. (a) Elucidate the working principle of pneumatic comparators.
(b) Explain the various alignment tests on drilling machine. [8+8]
8. (a) Enumerate various screw thread parameters for metrological measurement. Also enlist instruments corresponding to their measurements.

Code No: RR320302

Set No. 4

- (b) Describe with the help of a neat sketch the working of “Gear tooth vernier caliper”. [8+8]

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