

III B.Tech II Semester Regular Examinations, Apr/May 2008
METROLOGY AND SURFACE ENGINEERING
(Mechanical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. A 35 mm diameter shaft and bearing are to be assembled with a clearance fit. The tolerance and allowances are as under
- | | | |
|--------------------|---|----------|
| Allowances | = | 0.003 mm |
| Tolerance on hole | = | 0.007 mm |
| Tolerance on shaft | = | 0.002 mm |
- Find the limits of size for the hole and shaft if

- (a) Hole basis system is used
- (b) Shaft basis system is used

The tolerances are disposed of unilaterally. [8+8]

2. Explain and illustrate two simple tests on an optical flat which will reveal whether a surface is convex or concave with a neat sketch. [16]
3. What are the various instruments used for measuring flatness of a surface plate? Describe the test procedure by using one of such instrument. [16]

4. Explain how a pneumatic instrument is used as

- (a) Comparator
- (b) For either internal or external limit gauging. [8+8]

5. (a) State clearly the way in which the micrometer dials used for different thread pitches are graduated.
- (b) Explain how thread micrometer can be used to measure effective diameter of the screw thread. [8+8]

6. State and explain with sketches the various geometrical tests made on lathe machine tool before acceptance. [16]

7. (a) Describe the features of the coordinate measuring machine (CMM)?
- (b) Explicate gear metrology of spur gears with reference to Backlash. [8+8]

8. Explain various chemical cleaning processes in detail. Why surface cleaning is required. [16]

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1. (a) With the help of sketch describe a vernier type micrometer. How do you calculate its least count?
(b) Why is it necessary to check the flatness of the measuring faces of a micrometer and explain with an example? [8+8]
2. What do you understand by Moire fringes and how these are utilized for accurate length measurement? How can these be used for angular displacement. [16]
3. (a) Distinguish between straightness and flatness. List out the methods of measuring each of these.
(b) Explicate the use of interferometer in measuring flatness of surfaces. [8+8]
4. (a) How is the damping effect achieved in the sigma comparator? How it is different from other comparators.
(b) Explain the principle of pneumatic gauging by the 'back pressure' system and State range of pressures over which it is normally used. [8+8]
5. With the help of sketch describe how tool maker's microscope can be used to measure the elements of screw threads. [16]
6. (a) Distinguish between geometrical and practical tests on machine tools.
(b) Explain various instruments required for performing the alignment tests on machine tools. [8+8]
7. (a) What are various errors in gears? Explain, with neat figures.
(b) State the various sources of errors in manufacturing gears. [8+8]
8. Discuss different types of phosphate coatings. Give their applications. [16]

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1. With reference to the metrology, define and distinguish between the terms.
 - (a) Precision and Accuracy
 - (b) Repeatability and Reproducibility
 - (c) Nominal size and allowance
 - (d) Tolerance limits and Control limits. [4+4+4+4]

2. (a) What do you understand by a marking “1 Div = 0.005 mm in 100mm” found on a precision spirit level. Also describe how the accuracy of the graduations on a spirit level can be checked.
(b) Derive an expression for displacement of bubble in terms of radius of curvature, base length of level and displacement height. [8+8]

3. (a) What are the necessary conditions for interference of light waves?
(b) At what angle the bands should be viewed in interferometric measurement and what is the effect if it is too large? [8+8]

4. The heights of peaks and valleys of 20 successive points on a surface are 45, 25, 23, 22, 24, 53, 15, 22,64, 32, 63, 12, 23, 34, 55, 23, 11, 12, 17, 15 microns respectively, measured over a length 20 mm. Determine CLA and RMS values of roughness surface. [16]

5. (a) What are the different elements of a screw thread? What are the instruments used for the measurement of the elements of the screw thread.
(b) Can you apply Taylor’s principle of limit gauging to gauging of screw threads? If so, how? [8+8]

6. Explain with neat sketch the method of checking the following in the acceptability test of drilling machine.
 - (a) If the spindle is running true
 - (b) If the table and pillar are mutually perpendicular
 - (c) If the spindle perpendicular to the table. [4+6+6]

7. (a) Describe ‘Three Coordinate Measuring Machine CMM.
(b) Discuss various applications of Coordinate Measuring Machine (CMM). [8+8]

8. Describe in detail about the following surface coating processes.

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- (a) Sheradizing
- (b) Colorizing.

Give their applications.

[8+8]

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1. (a) With the help of sketch describe a vernier type micrometer. How do you calculate its least count?
(b) Why is it necessary to check the flatness of the measuring faces of a micrometer and explain with an example? [8+8]
2. Explain the Taylor's principle of limit gauging, with reference to gauging of rectangular holes. Discuss the effect of violating the Taylor's principle? [16]
3. (a) What are the measuring techniques employed in optical projector?
(b) Discuss the most common aberrations found in optical projector? [8+8]
4. What are the requirements of a good comparator? Explain, with the help of a neat sketch how these features are achievable in the "Sigma Comparator". [16]
5. (a) How is Taylor's principle of limit gauging applicable to gauging of screw threads.
(b) What are the elements required to be measured for determination of the accuracy of screw threads? Explain. [8+8]
6. Describe the following alignment tests on a pillar drilling machine.
(a) Square ness of the spindle axis with table.
(b) Perpendicularity of drill guide to the table. [8+8]
7. Explain with the help of sketches the working principles of the instruments used in checking of profile and base pitch of the gear. [16]
8. Explain the terms Dip coating and Spray coating. Distinguish between these two processes. Compare the merits and demerits. [16]
