

III B.Tech II Semester Regular Examinations, Apr/May 2006  
**METROLOGY**  
 (Mechanical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
 All Questions carry equal marks

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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. [6+10]
2. (a) Discuss the advantages of digital measuring instruments over others. What are progressive errors in micrometers?
- (b) Describe the uses and advantages of dial indicators. [8+8]
3. Discuss various methods of taper measurement of plug and ring gauges. [16]
4. (a) Differentiate between :
  - i. Standard gauges and limit gauges
  - ii. Ring gauges and plug gauges
- (b) Design general type GO and NO-GO gauges for components having 35 H6/e7 fit. The basic size falls in the diameter range of 30-50mm. The fundamental deviation for 'e' shaft= $(-11 D^{0.41})$  microns. The multipliers for 6 and 7 grades are 10 and 16. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values. [6+10]
5. What is Flatness? What are various methods of checking flatness of surfaces? Describe procedure for determining flatness of surfaces in laboratory. [16]
6. (a) What are the advantages and limitations of stylus probe?
- (b) Describe with a neat sketch the working of profilometer. [6+10]
7. (a) Enlist various types of mechanical comparators and optical comparators.
- (b) Describe the following alignment tests on a lathe for
  - i. Level of installation
  - ii. Parallelism of tailstock sleeve to saddle movement. [8+8]
8. (a) Elucidate the Effective diameter measurement by two wire method

(b) Explicate gear metrology of spur gears with reference to

- i. Lead
- ii. pitch

[8+8]

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1. (a) Explain the terms: Unilateral tolerance system, bilateral tolerance system. Clearly explain the differences between them
- (b) For each of the following shaft and hole pair, calculate shaft tolerance, hole tolerance and analyze whether the pair is
  - i. Clearance fit
  - ii. Transition fit
  - iii. Interference fit.

Pair 1: Hole:- $50^{+0.25}_{+0.00}$ mm	Shaft:- $50^{+0.05}_{+0.005}$ mm
Pair 2: Hole:- $30^{+0.05}_{+0.00}$ mm	Shaft:- $30^{-0.02}_{+0.05}$ mm
Pair 3: Hole:- $25^{+0.04}_{+0.00}$ mm	Shaft:- $25^{+0.06}_{+0.04}$ mm

Sketch the three fits. [8+8]
2. (a) Explicate the measurements reading on a micrometer and desirable precautions while reading measurements.
- (b) Describe the working mechanism of a dial indicator. [8+8]
3. (a) Explicate the principle of sine bar for angular measurement
- (b) Show the arrangement of angle gauges with neat sketches to measure
  - i.  $10^0 - 20'$  and
  - ii.  $56.26^0$  with minimum number of gauges from a set of
 

$[1^0, 3^0, 9^0, 27^0, 41^0]$
$[1', 3', 9', 27']$ and
$[3'', 6'', 18'', 38'']$

[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=(IT7 -IT6) 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. 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) **Explain** the details of construction, principle and operation of stylus. [8+8]
7. (a) Describe the working principle of a spherometer.
- (b) Explain the various tests on shaper for alignment. [8+8]
8. (a) **Explain** 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) Explain the terms: Hole based system, shaft based system. Enumerate the differences between them.  
(b) Determine and sketch the limits of tolerance and allowance for a 50mm shaft and hole pair designated  $H_7 - d_8$ . The basic size lies in the range of 30-50mm. The multipliers for grades 7 and 8 are 16 and 25 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. (a) Enunciate the use of sine bar for checking the angles of large sized components  
(b) The angle of wedge shaped block is being checked with 100mm Sine bar. With slip gauges of 26.867mm height at one end of Sine bar, the dial gauge readings at each end of the work piece vary by 0.06mm, the gauge block end being low. If the work piece is 30mm long what should be the next height of the gauge block tried ? Also calculate the angle of the work piece? [8+8]
4. (a) What material properties are "must" for gauges ?  
(b) Design general type GO and NO-GO gauges for components having 85 H8/n8 fit. The basic size falls in the diameter range of 80-100mm. The fundamental deviation for 'n' shaft= $(+D^{0.34})$  microns. The multipliers for 8 grade is 25. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values. [6+10]
5. Enumerate various optical methods of flatness testing. Describe the flatness testing with optical flats. [16]
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. [6+10]
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+8]
- 8. (a) Elucidate the measurement of effective diameter by three wire method
- (b) Explain gear metrology of spur gears with reference to
  - i. Back lash
  - ii. Tooth thickness [8+8]

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1. (a) Explain terms: Maximum metal limit; minimum metal limit; tolerance and allowance. Draw a conventional diagram to represent these terms for a shaft and hole of clearance fit.
- (b) For each of the following shaft and hole pair, calculate shaft tolerance, hole tolerance and analyze whether the pair is
- i. Clearance fit
  - ii. Transition fit
  - iii. Interference fit.
- |  |                                  |
|--|----------------------------------|
| Pair 1: Hole:- $60^{+0.26}_{+0.00}$ mm | Shaft:- $60^{+0.06}_{+0.006}$ mm |
| Pair 2: Hole:- $60^{+0.06}_{+0.00}$ mm | Shaft:- $60^{-0.02}_{+0.05}$ mm  |
| Pair 3: Hole:- $60^{+0.04}_{+0.00}$ mm | Shaft:- $60^{+0.08}_{+0.06}$ mm  |
- Sketch the three fits. [8+8]

2. (a) What are slip gauges ? What are their uses?
- (b) What are the requirements of a good dial indicator? What are advantages of it? [8+8]
3. (a) Discuss the practical uses and limitations of Tomlinson's angle gauges
- (b) A 100mm Sine bar is to be setup to an angle of  $9.23^{\circ}$  Determine the slip gauges needed from M87 set. If the angle is to be checked by angle gauges, what combination is needed from a the following set?

$[1^{\circ}, 3^{\circ}, 9^{\circ}, 27^{\circ}, 41^{\circ}]$   
 $[1', 3', 9', 27']$  and  
 $[3'', 6'', 18'', 38'']$

[8+8]

4. (a) Differentiate between :
- i. Standard gauges and limit gauges
  - ii. Ring gauges and plug gauges
- (b) Design general type GO and NO-GO gauges for components having 35 H6/e7 fit. The basic size falls in the diameter range of 30-50mm. The fundamental deviation for 'e' shaft= $(-11 D^{0.41})$  microns. The multipliers for 6 and 7 grades are 10 and 16. Take wear allowance as 10% of gauge tolerance. Sketch the gauges with values. [6+10]
5. What are the uses of optical flats? Describe testing of optical flats for flatness. [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) Enlist various types of mechanical comparators and optical comparators.
- (b) Describe the following alignment tests on a lathe for
  - i. Level of installation
  - ii. Parallelism of tailstock sleeve to saddle movement. [8+8]
  
- 8. (a) Describe an exclusive method for effective diameter measurement which shows variation in drunken thread.
- (b) **Explain** gear metrology of spur gears with reference to
  - i. Lead
  - ii. profile [8+8]

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