

III B.Tech. I Semester Supplementary Examinations, May -2005
METROLOGY AND QUALITY CONTROL
(Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Differentiate between Line Standard and End Standard of measurement. Bringout suitable examples under each category.
(b) Three 100 mm end bars are measured on a level comparator by first wringing them together and comparing with a 300mm bar and then inter comparing them. The 300 mm bar has a known error of $+42 \mu\text{m}$ and the three bars together measure 64 mm less than the 300 mm bar. Bar A is $18\mu\text{m}$ longer than Bar B and $23 \mu\text{m}$ longer than Bar C. Find actual length of each bar.
2. (a) Explain principles and uses of Sine bar in detail. How is it used for angle measurement ? What are its applications.
(b) Describe the different types of Spirit levels used in metrology. Define the following :
 - i. Sensitivity
 - ii. Level constant of a Spirit level.
3. (a) Describe the constructional features principle and working of Taylor-Hobson Talysurf. What are its advantages and list out limitations
(b) As per ISI specifications, how many roughness grade numbers are specified ? Draw the roughness symbol for each grade and indicate its roughness value. Explain how CLA index number is determined.
4. (a) Sketch and explain different types of profile and position gauges. How they can be used for measuring dimensions. Give examples
(b) Discuss the following with neat sketches
 - i. Progressive solid plug gauge and its use
 - ii. Salient features of a Taper plug gauge
5. (a) Describe the working and uses of Visual gauging head
(b) What are multichannel comparators ? Name the various types of multi-check comparators and explain any of them in brief.
6. (a) How does the error in flank angles affect the effective diameter of a screw threads? Describe the following methods of measuring effective dia of screw threads.
 - i. Thread Micrometer method
 - ii. One wire method

- (b) Write down the most important dimensions of V-type screw threads ? How do you check the pitch of a screw ring gauge ? Explain the type of instrument used ?
List out the elements of screw thread to determine accuracy ?
7. (a) Describe the various situations where a P-chart is clearly applicable. Give examples wherever necessary.
(b) Outline the step wise procedure in establishing \bar{X} -chart in a production process. Give suitable example.
8. (a) Explain the following terms and clearly show the differences between them. Give an example for each :
i. QC
ii. TQC
iii. TQM
iv. QA
(b) What do you mean by Lot control techniques. Explain the objectives of Quality control ? Differentiate between Total Quality Management and process capability in a manufacturing firm.

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1. (a) Briefly discuss the various steps involved in manufacturing of slip gauges ?
(b) Describe how a bored hole and 116.13 mm with a tolerance of ± 0.01 mm would be checked using slip gauges and accessories.
2. (a) Explain how
 - i. angle of a workpiece
 - ii. taper plug gauge is measured with the help of angle gauges ?Discuss with sketches.
(b) Calculate the angle of taper and minimum diameter of an internal taper from the following readings ?
 - i. Diameter of bigger ball = 10.25 mm
 - ii. Diameter of smaller ball = 6.07 mm
 - iii. Height of top of bigger ball from datum = 30.13 mm
 - iv. Height of top of smaller ball from datum = 10.08 mm
3. (a) Discuss the working of a profilograph with a neat sketch. What are its applications and limitations
(b) In the measurement of surface roughness, heights of 20 successive peaks and troughs were measured from a datum and were 35, 25, 40, 22, 35, 18, 42, 25, 35, 22, 36, 18, 42, 22, 32, 21, 37, 18, 35, 20 microns. If these measurements were obtained over a length of 20 mm, determine C.L.A. (R_a) and R.M.S value of the rough surface.
4. (a) Describe the principle and working of a profile projector. What are its advantage and applications ?
(b) Show by means of sketch the gauge required for checking a Taper shaft. Discuss in detail
5. (a) What are the advantages of comparators over conventional measuring instruments ? Explain any one mechanical comparator and its working with the help of sketch.
(b) Explain the principle and working of a Pneumatic comparator with a neat sketch.
6. (a) Discuss briefly of the following.
 - i. Screw thread micrometer and its working

- ii. Involute gear tester
- (b) What are the different elements of a screw thread ?
 - i. List out the instruments used for the measurement of above elements ?
 - ii. Define pitch of a thread. How it can be measured ?
- 7. (a) Following is the data enclosed showing the number of defectives in samples of 100 steel ingots.

Sample No:	1	2	3	4	5	6	7	8	9	10
Number of defectives	18	21	17	13	10	19	22	30	36	05

Draw a C-chart. Use graph sheet only.

- (b)
 - i. Differentiate between Attribute data and Variable data.
 - ii. Explain the constructional procedure for attribute chart.
- 8. (a) In a doubling sampling plan,
N = 10,000
 $n_1 = 100$
 $n_2 = 150$
 $c_1 = 0, c_2 = 2$
Determine the probability of acceptance of 1% defective lot.
- (b) Distinguish between sequential sampling and multiple sampling.

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1. (a) Describe any two methods of testing parallelism of micrometer measuring faces in detail.
 (b) Discuss the ratchet drive mechanism in case of a micrometer.
 (c) Distinguish between Primary, Secondary, Tertiary and working standards of length.
2. (a) Discuss briefly the Spirit level. What are the factors that determine the sensitivity and accuracy of Engineer's Spirit level ?
 (b) Sketch a Bevel protractor and explain its uses
 (c) With the help of Slips, rollers how do you determine taper angles of a taper plug gauge ? Sketch the experimental set up and explain procedure.
3. (a) How Tomlinson surface recorder and Talysurf machine works? Describe with a neat sketch ?
 (b) Calculate the R_a value of a surface for which the sampling length was 10mm, the graph was drawn to a vertical magnification of 1000 and areas above and below datum line were:

Above	180	90	155	$50mm^2$
Below	70	90	175	$145mm^2$

4. (a) Design the general type GO gauges and 'NO GO' gauges for components having 20H7 f8 fit. Given :
 - i. $i \text{ (microns)} = 0.45(D)^{1/3} + 0.0010$
 - ii. Upper deviation for shaft = $-5.5^{0.41}$
 - iii. 20mm falls in diameter step = 18 and 30 mm
 - iv. IT 7 = 16i, IT 8 = 25 I
 - v. Gauge Tolerance = wear allowance = 10% of work tolerance.
- (b) What are snap gauges? Compare its advantages over ring gauges? Explain how dimensions are measured by using snap gauges. Give examples.
5. (a) Describe and sketch two types of comparators with special reference to: the means of magnifying and movements of the stylus
 (b) the construction of the scale Compare the relative advantages and disadvantages of two comparators you have selected.
6. (a) List out the different elements required to be measured in order to determine the accuracy of screw threads.

- (b) What is meant by drunken thread ? What difficulties does it present in finding the pitch of the thread ?
 - (c) Draw the neat sketch of M30 thread and explain any one method of measuring its effective diameter.
7. (a) Define the term “Quality Conformance” Explain its objectives? Discuss the different factors influencing it ? Evaluate the concept of quality and its value?
- (b) Discuss various statistical tools for Quality control ? Explain graphical view of a Frequency distribution curve.
8. (a) Define the following :
- i. Quality Policy
 - ii. Quality Management
 - iii. Quality Plan and Audit
 - iv. Quality System
- (b) What are the various standards for Quality Management ? Discuss the objectives of ISO 9000. Briefly explain the function of each relevant standard?

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1. (a) Sketch an Inside Micrometer calipers and show various parts.
 - i. A bench micrometer was used for measuring the diameter of a plug gauge, using the setting cylinder, the following data were obtained :
 Nominal diameter of setting cylinder = 30.000 mm
 Reading on setting cylinder = 13.128 mm
 Reading on plug gauge = 15.134 mm
 What is the dia of gauge ? Also.
 Calculate the least count of a micrometer ?
- (b) Explain the spindle locking arrangement in micrometer with a neat sketch.
 What are the precautions to be taken in using Micrometer.
2. (a) Show, for a Sine Bar, that the error of angular setting θ arising from errors of the dimensions l and h is given by : $\Delta\theta(\text{radians}) = \frac{\text{Sec}\theta}{1}\Delta h - \frac{\text{Tan}\theta}{1}\Delta h$
- (b) Show that the sensitivity of the precision block level depends upon the radius of curvature of the vial only. How do you express its sensitivity.
3. (a) Discuss what do you understand by the following terms in connection with surface finish measurements :
 - i. Waviness
 - ii. Lay
 - iii. Roughness
 Explain them with diagrams
- (b) What is a profilometer ? Sketch a Profilometer and explain the procedure of measurement of Surface finish.
4. (a) Design the general type GO gauges and 'NO GO' gauges for components having 20H7 f8 fit. Given :
 - i. $i (\text{microns}) = 0.45(D)^{1/3} + 0.0010$
 - ii. Upper deviation for shaft = $-5.5^{0.41}$
 - iii. 20mm falls in diameter step = 18 and 30 mm
 - iv. IT 7 = 16i, IT 8 = 25 I
 - v. Gauge Tolerance = wear allowance = 10% of work tolerance.
- (b) What are snap gauges? Compare its advantages over ring gauges? Explain how dimensions are measured by using snap gauges. Give examples.
5. (a) What do you understand by the term "damping" of an instrument ?

- (b) How is damping effect achieved in the Sigma Mechanical comparator. Explain with sketch.
- (c) Briefly explain the working of mechanical optical comparator.
6. (a) Describe the base tangent method of gear measurement with a neat sketch.
- (b) Illustrate with sketch the usefulness of a gear tooth vernier calipers for measurement of Involute gear.
7. (a) Explain the differences between control charts for variables and control charts for attributes ? Discuss in detail by giving example for each.
- (b) 20 samples of parts were taken from a production line for gauging, each sample containing 100 parts. The following number of defectives were found in each sample.
- 2, 7, 3, 4, 4, 4, 3, 6, 3, 4
4, 3, 4, 5, 6, 5, 2, 5, 5, 7
- Calculate the \bar{p} value and estimate the control limits.
Plot the result on the chart
After the control chart on the above basis is compiled, the following defectives from the process for 10 samples of 100 each were obtained.
3, 4, 4, 3, 4, 5, 6, 10, 11, 8 defectives respectively.
What is your conclusion about the process ?
8. (a) State and explain the advantages and limitations of acceptance sampling over 100% inspection.
- (b) Define the terms :
- i. Quality
 - ii. Quality Assurance
 - iii. Quality Control
 - iv. Quality Circles
