

III B.Tech. I Semester Regular Examinations, November -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. [8+8]
2. (a) Discuss the geometrical relationships between various elements of a typical Sine Bar
(b) A 125 mm Sine bar is used to set up an angle of 27° , Find the list of slip gauges needed.
(c) Explain why it is not preferred to use Sine bar for measuring angles more than 90° [6+5+5]
3. (a) Discuss M-system and E-system of assessing surface Roughness. Explain their relative merits and demerits.
(b) Name the various methods of inspecting the surface finish by comparison. State their advantages and limitations.
(c) Explain the terms :
 - i. R_z value of surface finish
 - ii. Micro irregularities in Macro irregularities. [6+6+4]
4. (a) Design of the use of Taper limit gauges. How the limit gauges are useful in mass production
(b) Determine the size of 'GO' and 'NOGO' gauges for components having 30H7 / f8 fit. Being given with usual notations, $i(\text{microns}) = 0.453\sqrt{D} + 0.001$ ('D' in mm) [8+8]
5. (a) Describe briefly the working principle of the "Air Flow" type pneumatic comparator. Do we provide the control orifice in this comparator. Show the necessary sketches.
(b) In a pneumatic measuring system the scale length $R = 1,000 \text{ mm}$. Find the overall magnification if the linear range is to be 0.04 mm. [8+8]
6. (a) What do you understand by 'Constant Chord' caliper settings? Calculate the chord length and its distance below the teeth tip for a gear of module 2.5 mm and 14.50° pressure angle ?

- (b) Discuss the effects that are associated with type of errors in Screw threads.
How do you eliminate them. [8+8]
7. (a) Name the control charts for variables and attributes. How these are set up ?
(b) The data below shows the number of defectives over period of 20 days in a fixed sample size of 200
Determine, whether the data exhibit statistical control ?
Evaluate the preliminary and revised control limits for the process.

Day	No. of defectives	Fraction	Day	No. of Defectives	Fraction defective
1	10	0.050	11	21	0.105
2	15	0.075	12	15	0.075
3	10	0.050	13	8	0.040
4	12	0.060	14	14	0.070
5	11	0.055	15	4	0.020
6	9	0.045	16	10	0.050
7	22	0.110	17	11	0.055
8	4	0.020	18	11	0.055
9	12	0.060	19	26	0.130
10	24	0.120	20	13	0.065

[8+8]

8. (a) What are the important tools of quality for TQM ? Briefly discuss the importance of TQM ? Define ISO 9000. Show how it is a part of TQM ?
(b) In a single sampling plan, $N = 10,000$ and $C=1$. Find the sample size when the probability of acceptance of 0.5% defective lot is 0.025. Compute the average outgoing quality. [8+8]

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1. (a) Explain clearly with a sketch, a typical application of dial indicator for setting up purposes on :
 - i. The milling machine
 - ii. the drilling machineIn each case clearly state with diagram
 - A. The object of the test
 - B. The attachments required
 - C. The method of mounting the indicator
 - D. The motion to be used
- (b) Describe various mechanisms to obtain high magnification in dial indicators.
[8+8]
2. (a) Derive the expressions used and explain the procedure to determine
 - i. The angle of a taper plug gauge
 - ii. The small end diameter, using Sine bar, Slip gauges, a roller and a dial gauge.
- (b) A 100 mm Sine bar is to be set up to an angle of 33° , Determine the slip gauges needed from 87 pieces set. Briefly state the features of Sine Bar which have tolerances for accuracy. [8+8]
3. (a) With the help of neat sketch describe the construction and working of Tomlinson surface meter. What are its applications
- (b) Discuss the following terms in connection with surface texture assessment :
 - i. Effective Profile
 - ii. Normal surface
 - iii. Roughness width
 - iv. Centre line of profile[8+8]
4. (a) Why a NOGO gauge should incorporate minimum metal limit of a single dimension at a time ? Explain. Is it true that GO gauge should always be a full form gauge ? Discuss with neat sketches
- (b) Differentiate between the followings:
 - i. Workshop gauges and inspection gauges
 - ii. Precision instruments and Gauges

- iii. GO thread plug gauge and NO GO thread plug gauge [8+8]
5. (a) Describe the following comparators in brief :
- i. Brookes Level comparator
 - ii. Eden-Rolt Millianth comparator
- (b) How the overall magnification can be achieved in a Mechanical-Optical comparator ? Discuss the principle of this comparator with a neat sketch. [8+8]
6. (a) Compare two-wire and three-wire methods of measuring the effective diameter of a screw.
- (b) Explain how the various elements of internal threads are measured using a pitch measuring machine. [8+8]
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+8]
8. (a) Briefly describe the single and double sampling plans. How can they be differed from sequential plans ?
- (b) Describe the following :
- i. Acceptance sampling
 - ii. Zero Defect programmes
 - iii. Rectification plans [8+8]

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1. (a) Explain Brook-Level comparator with a neat sketch. How it can be used for calibration of slip gauges.
(b) How are gauge blocks specified ? Discuss a procedure to build up gauge blocks to produce a dimension of 43.716 mm using M45 set of slip gauges. [8+8]
2. (a) Derive the expressions used and explain the procedure to determine
 - i. The angle of a taper plug gauge
 - ii. The small end diameter, using Sine bar, Slip gauges, a roller and a dial gauge.(b) A 100 mm Sine bar is to be set up to an angle of 33° , Determine the slip gauges needed from 87 pieces set. Briefly state the features of Sine Bar which have tolerances for accuracy. [8+8]
3. (a) Describe the principle and working of Tracer type profilogram with the help of a neat sketch
(b) The surface finish on the milled surface is not to exceed $5\mu\text{m } R_a$ with a cut-off length 2 mm, machining allowance 0.5 mm and direction of lay parallel. How will you represent it on a drawing ?
(c) It is not possible to produce perfectly "smooth" surface. Justify the statement. [8+4+4]
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 [8+8]
5. (a) Explain the Johnson 'Mikrokator' with a neat sketch. Mention its characteristics and uses.
(b) Discuss the following :
 - i. Constructional features of any mechanical comparator.
 - ii. Constructional features and working of solex pneumatic comparator. [8+8]
6. (a) What are the various parameters to be checked to find the accuracy of gear ? Describe gear tooth Vernier Calipers with a sketch and show how this is used for checking the gears.

- (b) Discuss the different types of pitch errors of screw threads. Explain with sketch. How the pitch errors can be checked for screw threads ? [8+8]
7. (a) Discuss the reasons for using \bar{X} and R charts simultaneously. Explain with examples.
- (b) The average fraction rejected is $\bar{P} = 0.75$. Determine the 3 ' σ ' control limits for P-chart. [8+8]
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. [8+8]

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1. (a) Sketch and explain the working of a Dial Indicator ? Enumerate the advantages and limitations of Dial Indicators?
(b) What are the various requirements of a Good dial indicator? Discuss with a neat sketch about the working mechanism of gear and Pinion type Dial Indicators. [8+8]
2. (a) Explain how you determine the taper angle of a taper ring gauge using spheres and Depth micrometer. Derive the expression used.
(b) Why is a sine bar not used for generating angles greater than 45^0 , if high accuracy is needed ? Explain it with a suitable graph. Explain the different sources of errors in Sine Bars. [8+8]
3. (a) Describe various electrical surface finish measuring instruments with sketches. Bring out their salient features
(b) Indicate how various surface roughness specifications are placed relative to the symbol. List out various symbols of direction of lay and give their applications? [8+8]
4. (a) State why and how wear allowance are considered to gauge design?
Show with neat sketches of the following:
 - i. Double-ended snap gauge
 - ii. Progressive type snap gaugeHow do you use them for checking dimensions
(b) Describe with neat sketches:
 - i. Inserted type plain plug gauge
 - ii. Double ended plug gauges
 - iii. Pilot plug gauge
 - iv. Fastened type plug gauge [8+8]
5. (a) What do you mean by 'pressure sensitive air gauging'. How it can be applied to a pneumatic comparator ? Discuss with a neat sketch ?
(b) Discuss the following with reference to pneumatic comparator
 - i. Pneumatic sensitivity
 - ii. Overall magnification of pneumatic system [8+8]

6. (a) What are the various parameters to be checked to find the accuracy of gear ? Describe gear tooth Vernier Calipers with a sketch and show how this is used for checking the gears.
- (b) Discuss the different types of pitch errors of screw threads. Explain with sketch. How the pitch errors can be checked for screw threads ? [8+8]

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+8]

8. (a) Briefly describe the single and double sampling plans. How can they be differed from sequential plans ?

- (b) Describe the following :
- i. Acceptance sampling
 - ii. Zero Defect programmes
 - iii. Rectification plans

[8+8]
