

- NB: -**
1. Question No.1 is compulsory
 2. Solve any three questions from remaining five
 3. Assume suitable data wherever necessary

Q.1 Answer the following questions:

- a) The surface finish on the milled surface is not to exceed $5\mu\text{m } R_a$ with a cutoff length 2mm, machining allowance 0.5mm and direction of lay parallel. How will you represent it on a drawing? 04
- b) Calculate the effective diameter if: a) the micrometer reading with two wires of standard cylinder is 15.64mm. b) Micrometer reading over the gauge with two wires as 15.26 mm and pitch of thread 2.5mm. c) Wires of 2.00 mm diameter and standard cylinder 18mm. 04
- c) What are the limitations of X bar and R charts. 04
- d) Explain Taylor's principle of Gauge Design. 04
- e) What are the objectives of Quality control? 04

Q.2

- a) With the help of neat sketch explain the construction, working and applications of tool maker's microscope. 10
- b) By using optical flat and monochromatic light explain the procedure to determine i) whether the given surface is flat or curved. ii) whether the curved surface is convex or concave. 10

Q.3

- a) Explain the following terms with respect to Gear Measurement: a) Measurement using rollers b) gear tooth comparators. 10
- b) How to obtain balance between cost of quality and value of quality? Explain your answer with suitable graph. 10

Q.4

- a) In the measurement of surface roughness, heights of the successive 10 peaks and troughs were measured from a datum and were 33, 25, 30, 19, 22, 18, 27, 29, 32 and 20 microns. If these measurements were obtained over a length of 10mm, determine CLA and RMS values of surface roughness. 05
- b) Distinguish between Hole Basis and Shaft Basis system. 05
- c) Explain the principle and working of electrical comparator along with its advantages and limitations. 10

Q.5

- a) In a capability study of a lathe used in turning a shaft to a diameter of 23.75 ± 0.1 mm a sample of 6 consecutive pieces was taken each day for 8 days. The diameters of these shafts are as given below: 10

1 st day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day	8 th day
23.77	23.80	23.77	23.79	23.75	23.78	23.76	23.76
23.80	23.78	23.78	23.76	23.78	23.76	23.78	23.79
23.78	23.76	23.77	23.79	23.78	23.73	23.75	23.77
23.73	23.70	23.77	23.74	23.77	23.76	23.76	23.72
23.76	23.81	23.80	23.82	23.76	23.74	23.81	23.78
23.75	23.77	23.74	23.76	23.79	23.78	23.80	23.78

Construct the appropriate control chart and find out process capability for the machine. (For subgroup size of 6, take $A_2=0.48, D_3=0, D_4=2$ and $d_2=2.534$)

- b) Explain the Operating Characteristic (OC) curve with reference to sampling inspection. Also show different regions in the same with their suitable meaning. 10

Q.6

- a) Explain various types of sampling plans which are in practice in industry with their respective acceptance criteria. 10
- b) In a factory producing spark plugs the number of defectives found in inspection of 20 lots of 100 each, is given below: 10

Lot. No.	No of Defectives	Lot No.	No of Defectives
1	5	11	4
2	10	12	7
3	12	13	8
4	8	14	3
5	6	15	3
6	4	16	4
7	6	17	5
8	3	18	8
9	3	19	6
10	5	20	10

- i. Construct appropriate control chart and state whether the process is in statistical control.
- ii. Determine the sample size when a quality limit not worse than 9% is desirable and 10 % bad product will not be permitted more than three times in thousand.
