B.E. PRODUCTION ENGINEERING SECOND YEAR SECOND SEMESTER EXAM 2017

INSPECTION AND PRODUCT CONTROL

Time : **Three hours** Full marks: **100**

Question Number 1 is compulsory and it should be answered in continuity. Answer another three questions from the rest.

1. (a) State how 'inspection' is related with 'product control'. (4×10)

   (b) Describe the Indian Standard for shaft and hole assembly.

   (c) Describe how the principle of light inference can be used to determine the error in slip gauges.

   (d) Based on the following information, determine the Rz value. (All dimensions are in μm)

Peak	12	10	18	17	19	15	20
Valley	8	9	7	6	10	12	13

   (e) Develop the corresponding Pareto chart showing the production of defective components from a turning operation.

   (f) State the role of 'stem and leaf' diagram in product control.

   (g) How the Coordinate Measuring Machine can be employed to measure the eccentricity and flatness errors in manufactured jobs.

   (h) How the quality control charts are interpreted? What are the main disadvantages of control charts?

   (i) Describe in details two indirect methods for surface roughness measurement.

   (j) State the applications of machine vision system in inspection and product control.

2. With neat diagrams, explain the working principle of the following instruments: (4×5)

   (a) NPL interferometer, (b) Talysurf 6, (c) Mechanical-optical comparator, and (d) Plain plug gauge.

3. (a) State why 3-sigma limits are deployed while developing control charts. (5)

   (b) Specifications on the dimensions of a certain part are 101.550±0.200 mm. Parts produced outside these specifications must be scrapped. Two automatic machines produce these parts at a rate of 100 units per hour each. Items from both the machines are discharged into a single bin from which the inspector selects a sub-group of 5 parts every half an hour. Adjustments to both machines are made only on the approval of the inspector.

   (i) After 50 sub-groups have been drawn, $\sum \bar{X} = 72.25$ and $\sum R = 8.80$. To simplify the arithmetic, 100 has been subtracted from each value of X. Determine the control limits for $\bar{X}$ and R charts.
   (ii) Assuming no points are outside the control limits of either chart and based on normal distribution, what would you estimate the fraction non-conforming to be?
   (iii) Determine the value of process capability and highlight whether the machines have been capable of meeting the specification limits?
   (Given for n = 5, $A_2 = 0.58$, $D_3 = 0$, $D_4 = 2.11$, $d_2 = 2.236$ and the area between z = 0 to z = -1.255 is 0.3953) (15)

4. (a) Differentiate between selective assembly and universal interchagebility. (6)

   (b) Write a short note on bearing area curve. (4)

   (c) Citing appropriate examples, differentiate the measuring instruments according to accuracy and also according to the purpose of measurement. (6)

   (d) How the plain gauges are classified? (4)

5. (a) Prove that the sensitivity of a back pressure type of pneumatic comparator is inversely proportional to the average clearance between the gauge head and test piece. (10)

   (b) With examples, distinguish between off-line and on-line inspection systems. (4)

   (c) In the manufacture of certain products, approximately 200 units are produced and subjected to final inspection daily. At the end of 20 working days, 230 units have been rejected out of 4150 units produced and inspected. Determine the control limits for a p-chart based on the average daily production of 200 units. Only one point on the control chart plot is assumed to fall outside the limits. On that day, 30 non-conforming units were found in 200 units inspected. Now compute the new control limits for the chart based on 200 units daily production assumption. (6)