B.E. PRODUCTION ENGINEERING SECOND YEAR SECOND SEMESTER EXAM
2018

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 why the concept of 'Inspection and Product Control' is crucial in present day manufacturing systems.   (4×10)

(b) How can the control charts be interpreted?

(c) State how the following features can be measured using the conventional measuring instruments.

(i) a hole having 1.001 mm diameter, (ii) thickness of a recess, (iii) included angle of a dovetail slot and (iv) cylindricity error of a through hole.

(d) Why are X-bar and R charts used conjointly? What is statistical quality control?

(e) State the merits and demerits of having a rough surface.

(f) Describe the role of scatter diagram as an effective quality control tool.

(g) How the Coordinate Measuring Machine can be applied to measure internal taper angle and out of roundness error of manufactured jobs.

(h) State the working principle of a computer vision system for measuring product dimensional features.

(i) Differentiate between C_p and C_{pk}. Between them, which one is preferred and why?

(j) Mention the major advantages and disadvantages of mechanical-optical type of comparators.

2. With neat diagrams, describe the working principle of the following measuring instruments:

(a) Sigma comparator, (b) Alternative Current Laser Interferometer, (c) Tomlinson Surface meter and (d) Position gauge.   (4×5)

3.(a) State the purpose of developing a p-chart.   (4)

(b) Write a short note of sequential acceptance sampling plan.   (4)

(c) An item is made in lots of 200 each. The lots are given 100% inspection. The record sheet for the last 25 lots inspected showed that a total of 75 items were defective.

(i) Determine the trial control limits for np chart showing numbers of defectives in each lot. (ii) Assume that all points fall within the control limits. What is your estimate of the process average fricative defective? (iii) If this p value remains unchanged, what is the probability that the 26th lot will contain exactly 2 defectives?   (12)

4.(a) Determine the GO and NOGO dimensions of standard gauges to control the production of 90 mm. shaft and hole pairs of H_8f_9 fit as per I.S. specifications given as below:
(i) 90 mm. lies in the diameter step of 80 and 100 mm.
(ii) Fundamental deviation of 'e' type shaft is $-5.5 D^{0.41}$, where D = geometric mean of diameter steps in mm.
(iii) Wear tolerance = 10% of the gauge tolerance.   (15)

(b) How can the gauges be classified?   (5)

5.(a) For a pneumatic comparator, the relationship between various parameters can be depicted as follows: (12)

p/P = 1.10 − b M/c   for 0.6 > p/P > 0.8
where, P = supply pressure,

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p = pressure between measuring and control orifices,

b = constant = 0.25 for P of 1.5 kg/cm^2,

M = πDL

L = separation between nozzle surface and the surface to be gauged,

D = orifice diameter,

d = control orifice diameter,

c = control orifice area.

For a pneumatic comparator, the control orifice and measuring orifice diameters are 0.20 and 0.30 mm respectively and the supply of air is at 1.5 kg/cm^2 pressure.

Now, evaluate the range of linear measurement.

(b)   Differentiate between the followings:

(i) Selective assembly and universal interchagebility, (ii) Repeatability and readability.   (4×2)

6.(a)   Describe various indirect methods of measuring surface roughness of manufactured products. (12)

  (b)   Define i) Peak count, ii) Rz value and iii) R_a value and iv) Center line.   (4×2)