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10ME668

Sixth Semester B.E. Degree Examination, Jan./Feb. 2021
Statistical Quality Control

Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting atleast TWO questions from each part.

PART – A

- 1 a. Define the term quality and distinguish clearly between quality of design and quality of conformance. (10 Marks)
b. Write short notes on quality costs. (06 Marks)
c. Define T.Q.M explain how T.Q.M can be ensured in the organization. (04 Marks)
- 2 a. Distinguish clearly between mean, median and mode as measures of central tendency. (06 Marks)
b. Briefly explain the Deming Funnel Experiment. (06 Marks)
c. Tests have indicated that the tensile strength of certain aluminium alloys averages $1,785\text{kg/cm}^2$ with a standard deviation of 220kg/cm^2 . If the distribution is normal what percentage of the casting will have i) Tensile strength less than 1400kg/cm^2 ii) more than 1500kg/cm^2 . (08 Marks)
- 3 a. Differentiate between the chance causes and assignable causes of variation giving suitable example. (08 Marks)
b. Explain the factors to be considered in determining :
i) Sample size/subgroup size
ii) Frequency of subgrouping/sample. (06 Marks)
c. Define warning limits and explain its importance with suitable figure. (06 Marks)
- 4 a. Briefly explain with suitable example TYPE I and TYPE II errors. (06 Marks)
b. List the control charts available for variables and briefly write the procedure for construction of $\bar{X}-R$ charts. (08 Marks)
c. Determine the control limits for $\bar{X}-R$ charts if $\Sigma\bar{X} = 357.50$, $\Sigma R = 9.90$, number of subgroups = 20 from the tables, it is given that $A_2 = 0.18$, $D_3 = 0.41$, $D_4 = 1.59$ and $d_2 = 3.735$. (06 Marks)

PART – B

- 5 a. Define process capability and explain methods to measure process capability. (06 Marks)
b. Control charts for \bar{X} and R are maintained on a certain dimension of a manufactured part which is specified as $2.05 \pm 0.02\text{cms}$. Subgroup size is 4. The values of \bar{X} and R are computed for each subgroup. After 20 subgroups $\Sigma\bar{X} = 41.283$ and $\Sigma R = 0.280$. If the dimensions fall above USL rework is required, if below LSL, the part must be scrapped. If the process is in statistical control and normally distributed.
i) Determine the 3σ control limits for $\bar{X}-R$ chart
ii) What is the process capability
iii) What are your suggestions for improvement? (14 Marks)

- 6 a. What is the difference between defect and defective also distinguish between P-chart and C-Chart. (08 Marks)
- b. A manufacture purchases small bolts in cartons that usually contain several thousand bolts. Each shipment consists of a number of cartons. As a part of the acceptance procedure for these bolts, 400 bolts are selected at random from each carton and are subjected to visual inspection for certain defects. In a shipment of 10 cartons the respective percentages of defectives in the samples from each carton are 0, 0, 0.5, 0.75, 0, 2.0, 0.25, 0, 0.25 and 1.25. Does this shipment of bolts appear to exhibit statistical control with respect to the quality characteristics examined in the in section? (12 Marks)
- 7 a. Explain the OC curve with reference to sampling inspection and the memory of the terms :
i) AQL ii) LTPD iii) IQL iv) Producer's risk v) Consumers risk. (10 Marks)
- b. In a double sampling plan $N = 5000$, $n_1 = 100$, $c_1 = 0$, $n_2 = 100$ and $c_2 = 1$ as use Poisson's table to compute the probability of acceptance of a 1% defective lot. (10 Marks)
- 8 A Write a short notes on :
i) CUSUM control chart (10 Marks)
ii) EWMA control chart. (10 Marks)
- b. Briefly explain how CUSUM chart is used for maintain the process mean with example. (10 Marks)

