[123]   SEAT No._____

SARDAR PATEL UNIVERSITY
M.Sc External Examination, Semester - IV.
Wednesday Date : 20-03-2019
Time : 2.00 pm to 5.00 pm
Subject/Course Code :PSO4CSTA02/22
Statistical Quality Control Technique

Q-1   In context of SQC answer following.

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   (1)   CUSUM control chart introduce by

       a   Shewhart.
       b   Taguchi.
       c   Doge.
       d   Non-of-above.

   (2)   Chain sampling introduce by

       a   Shewhart.
       b   Taguchi.
       c   Doge.
       d   Non-of-above.

   (3)   Manufacturing operation do not result in the natural formation of lot. We recommend acceptance sampling plan name

       a   Chain sampling plan.
       b   Skip-lot sampling plan.
       c   Continuous sampling plan.
       d   Non-of-above.

   (4)   Vendor's process out-put is defect-free. We recommend acceptance sampling plan name

       a   Chain sampling plan.
       b   Skip-lot sampling plan.
       c   Continuous sampling plan.
       d   Non-of-above.

   (5)   Probability limits are use with standard probability level $\alpha = 0.001$ in

       a   U.K and part of western Europe.
       b   India and part of western Europe
       c   Japan and part of western Europe.
       d   Non-of-above.

   (6)   Between-sample variability monitor by

       a $\bar{\bar{X}}$ chart.
       b   R chart.
       c   S chart.
       d   Non-of-above.

   (7)   The term robust mean

       a   Good.
       b   Batter.

c Best.

d Non-of-above.

(8) Process capability is

a Measure potential capability of process.

b Measure actual capability of process.

c Measure # of non-conforming produced by process.

d Non-of-above.

Q-2 In context of SQC answer following. 14

1 Sample of 20 normally distributed quality characteristic had $\bar{X} = 350$ and $\sigma = 10$. Compute natural upper tolerance limits that has probability of 0.9 of containing 95 % of this quality characteristic.

2 $\bar{X}$ chart on normally distributed quality characteristic have mean 100 and s.d 8. Compute two-sided 0.005 probability limits.

3 React and justify : Average of individual (observation) is more normal than individual (observation).

4 In acceptance sampling, accepted lot being no better than the rejected lot. we should study acceptance sampling plan. Why ?

5 From normal probability plot one can estimate s.d σ.

6 For model : $y_{ijk} = \mu + \alpha_i + \beta_j + \gamma_{ij} + e_{ijk}$, write expression for $\hat{y}_{ijk}$.

7 In usual notation of singly replicate 2^4 design, the response of main effect of (b) is 7.134. BC interaction coded by $X_1 X_2$ in regression model : $\hat{y} = 25.97 + (5.437)X_1 + (14.14)X_2 + (9.23)X_1 X_2 + e$. Compute residual for main effect of b.

8 In usual notation of SQC, given specification 8 ± 0.08 and $PCR = 0.17$. Compute s.d.

9 What do you mean by term "quality" ?

Q-3 A In context of SQC answer following. 6

1 Interpret : $ARL = 437$.

2 Explain the term back ground noise.

3 On the basis of P/T ratio when gage is call adequate ?

②

4 There is close connection between control chart and testing of hypotheses frame work but there is difference between them in view point. State the difference in view point between control chart and testing of hypotheses frame work.

Q-3 B Normally distributed quality characteristic monitor by $\bar{X}$ chart :[614, 620, 626] and R chart :[0, 8.236, 18.795] based on sample size 4 and specification 610 ± 15. Compute # of non-conforming in ppm.   6

OR

B Normally distributed quality characteristic monitor by $\bar{X}$ chart :[690, 700, 710] and S chart :[0, 7.979, 18.08] based on sample size 4 and specification 705 ± 15. Compute $\alpha -$ risk.

Q-4 A In context of SQC answer following.   6

1 Use of sensitizing rules in Shewhart control chart for control process is not desirable. Why ?

2 Describe use of slack value in CUSUM control chart.

3 What do you mean by "precision" ?

4 In context of SQC write demerit of PCR_K.

Q-4 B Rectangle piece of metal of width W and length l, is cut from plate of thickness T. The W, L and T are independent random variables with mean and standard deviation (s.d) as $(W; 10 \text{ cm}, 0.2 \text{ cm})$, $(L; 20 \text{ cm}, 0.3 \text{ cm})$ and $(T; 05 \text{ cm}, 0.1 \text{ cm})$. The density of metal is 0.08 g/cm^2. What would be estimated mean and s.d of weight; $Weight = (W)(L)(T)(\text{density})$ of pieces produced by this process.   6

OR

B Three parts are assembled in series so that their critical X_1, X_2, X_3 add. The dimensions of each part are normally distributed with the following parameters. $\mu_1 = 100$, $\mu_2 = 75$, $\mu_3 = 75$, $\sigma_1 = 4$, $\sigma_2 = 4$ and $\sigma_3 = 2$. Compute probability that an assembly chosen at random will have a combined dimension in excess of 262 ?

Q-5 A In context of SQC answer following.   6

1 Rejection of H_0 is always strong conclusion.

③   CP·T·0)

2 For complex assembly process we recommend continuous acceptance sampling plan. Justify.

3 Write (SN) signal to noise ratio.

4 In 2^{4-1} design with identifying relation $I = ABCD$ and BCD is aliases of A. How $I = ABCD$, identify relation $A = BCD$?

Q-5 B Consider process with $n = 5$, $\bar{\bar{X}} = 10.375$, $\bar{R} = 6.25$,   6
specification $USL = 50$, $LSL = -50$, $T = 0$. Compute (1) potential capability (2) actual capability (3) PCR_{km}

<div align="center">OR</div>

B 10 parts are measured three times by same operator in gage capability study. Partial work is $\bar{\bar{X}} = 98.2$, $\bar{R} = 2.3$, $T = 100$, $\hat{\sigma}^2_{total} = 4.717$, $LSL = 85$, $USL = 115$. Compute (1) $\hat{\sigma}^2_{product}$ (2) (P/T) ratio. (3) Percentage of product characteristic variability (Percentage of total variability due to gage)

Q-6 A In context of SQC answer following.   6

1 Write list (with no detail) of analysis procedure for factorial design.

2 Write resolution IV designs, give example.

3 React and justify : Operation on target is more impotent than conformance.

4 What do you mean by term robust.

Q-6 B In context of SQC explain : (1) Concept of interaction. (2) Use of parallelism of two line in absence of interaction in two way data.

<div align="center">OR</div>

B In context of SQC for one-half of 2^4 factorial design explain the terms :

(1) Generator   (2) Identifying relation

(3) Principle and Alternate fraction   (4) Aliases

(5) One-half of 2^4 factorial design is full one-half of 2^3 factorial design

REQUIRE STATISTICAL TABLES WILL BE PROVIDED

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<div align="center">(4)</div>