

Seat No. : _____

AC2-07

April - 2018

B.Sc., Sem.-VI

**CC-309 : Statistics
(Statistical Quality Control)**

Time : 3 Hours]

[Max. Marks : 70

- Instructions :**
- (1) Scientific calculator is permitted to use.
 - (2) Statistical table will be given on demand.
 - (3) **All** questions are of equal marks.

1. (a) What is quality and Statistical quality control ? Discuss its importance.

OR

Discuss different types of causes of variation in product quality.

- (b) What do you mean by tolerance limits ? How they are determined ?

OR

Discuss theory of runs and its application in detecting lack of control.

2. (a) Discuss joint significance of \bar{X} and R charts. An \bar{X} chart uses samples of size 4. The center line is at 100, and the upper and lower 3-sigma control limits are at 106 and 94, respectively.
- (i) What is the process standard deviation ?
 - (ii) Suppose the process mean shifts to 96. Find the probability that this shift will be detected on the next sample.

OR

Stating necessary assumptions, derive control limits of control charts for mean and standard deviation. When S- chart is used in place of R- chart ?

- (b) Discuss the difference between control charts for variables and attributes.

OR

Write note on p and np charts.

3. (a) What is lot control and process control ? Discuss the terms: Producer's risk and consumer's risk, AQL and LTPD.

OR

What is single sampling plan for attributes ? For a large lot a sample of size 20 is taken. If it contains not more than one defective, the lot is accepted. If the sample contains two or more defective, the lot is rejected. Find $L(p)$, the probability of acceptance and AOQ, when the lot fraction defective is $p = 0.02$.

- (b) Describe construction of Single Sampling Plan from the given two points on the OC curve. What do you mean by rectification of the plan ?

OR

Describe double sampling plan. Consider a double sampling plan as follow :

"Select a sample of size 2 from a lot of 20. If both articles inspected are good, accept the lot. If both are defective, reject the lot. If 1 is good and 1 is defective, take a second sample of one article. If the article in the second sample is good , accept the lot. If it is defective reject the lot." In case of a lot 25% defective is submitted, what is the probability of acceptance ? What is the probability of acceptance on the basis of single sample only ? What is the probability of decision on the basis of single sample only ? Compute these by the method which is theoretically correct.

4. (a) What is sampling plans for variables ? How they differ from the sampling plan for attributes ?

OR

Describe sampling plan for variables when σ is known and UCL is specified.

- (b) Determine the variable sampling plan that will accept 90% of the lot with 2% defectives and reject 95 % lots with 5% defectives when $S = \hat{\sigma} = 30$ and (i) the upper specification limit = 500 (ii) the lower specification limit is 150.

OR

Determine the variable sampling plan that will accept 95% of the lot with 1% defectives and reject 90 % lots with 1% defectives when $\sigma = 30$ and (i) the upper specification limit = 600 (ii) the lower specification limit is 200.

5. Answer the following :

- (i) State general 3σ control limits.
 - (ii) State 3σ control limits for control chart of mean when process mean and standard deviations are known.
 - (iii) When the process is said to be out of control even if all the points are within the control limits ?
 - (iv) State an example of chance cause.
 - (v) State the general rule for considering subgroups in SQC.
 - (vi) State specification limits.
 - (vii) When modified control limits are used ?
 - (viii) When sample size is 4, what will be LCL for R-chart ?
 - (ix) Estimate σ when $\bar{R} = 3.57$ and $n = 3$.
 - (x) Define AOQ and AOQL.
 - (xi) Define ASN.
 - (xii) Define ATI.
 - (xiii) State the formula for n in single sampling plan for variable when LCL is given and σ is unknown.
 - (xiv) State the distribution used in single sampling plan for variables.
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