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3 (Sem-4/CBCS) STA HC 3

2022

**STATISTICS**

(Honours)

Paper : STA-HC-4036

**(Statistical Quality Control)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following as directed : **(any seven)**  $1 \times 7 = 7$

(a) Main tool of statistical equality control is

(i) W. A. Shewhart chart

(ii) Acceptance sampling plan

(iii) Both (i) and (ii)

(iv) None of the above

*(Choose the incorrect option)*

Contd.





(b) Which one of the following is not a control chart for variable ?

- (i)  $\bar{X}$  - chart
- (ii)  $\sigma$  - chart
- (iii) R - chart
- (iv) C - chart

(Choose the correct option)

(c) In control chart for standard deviation an estimate of the population standard

deviation is  $\hat{\sigma} = \frac{\bar{S}}{c_2}$ .

(State True or False)

(d) If the lower control limit is found negative in case of control charts for attributes, then it is taken to be \_\_\_\_\_.

(Fill in the blank)

(e) The control chart for fraction defective is called  $np$ -chart.

(State True or False)

(f) The probability of accepting a lot with fraction defective  $P_t$  is known as

- (i) consumer's risk
- (ii) producer's risk

(iii) type-I error

(iv) None of the above

(Choose the correct option)

(g) In the construction of a control chart the extreme control limits are fixed at a distance of

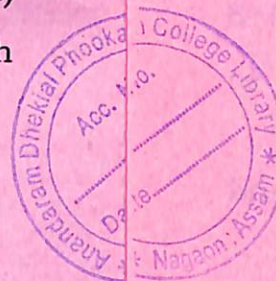
- (i)  $\sigma$
- (ii)  $2\sigma$
- (iii)  $3\sigma$
- (iv)  $2.58\sigma$

(Choose the correct option)

(h) A curve showing the probability of accepting a lot  $P_a(p)$  for variation in the incoming lot of quality  $p$  is known as

- (i) O. C. curve
- (ii) A. S. N. curve
- (iii) A. O. Q curve
- (iv) None of the above

(Choose the correct option)





(c) Explain the term 'natural tolerance limits'.

(d) When is S-chart used in place of R-chart?

(e) Write down the control limits in p-chart if 50 blades are found defective in a consignment of 200 blades.

(f) What are the limitations of the control charts for variables?

(g) What do you understand by acceptance quality level (A.Q.L)?

(h) What is meant by control limits?

Answer **any three** of the following questions :  $5 \times 3 = 15$

(a) Discuss the construction of p-chart when all samples are of same size. How is the procedure modified for variable sample size?

(b) Compare the charts of variable and charts of attributes.

(c) Explain acceptance sampling plan.

(i) If the lot is accepted on the basis of the sample inspection plan, then

(i) ATI = ASN

(ii) ATI > ASN

(iii) ATI < ASN

(iv) None of the above

(Choose the correct option)

(f) In a control chart the upper control limit can be

(i) negative

(ii) never negative

(iii) zero

(iv) either negative or positive

(Choose the correct option)

2. Answer **any four** of the following questions :  $2 \times 4 = 8$

(a) What is meant by process control in industrial statistics?

(b) Distinguish between chance causes and assignable causes in SQC.



3.



- (d) Describe the control chart for S. What are the advantages of S-chart over the R-chart ?
- (e) Discuss the relative merits and demerits of single and double sampling plans.
- (f) Write briefly a note on historical perspective of quality control.
- (g) Write briefly the overview of six-sigma limit.
- (h) A machine is set to deliver packets of a given weight. Weights for six samples of size 5 each were recorded. Mean and range of each sample are given below :

Sample no :	1	2	3	4	5	6
Mean :	14	18	16	15	17	16
Range :	7	6	6	4	8	5

Find the control limits for mean and range charts. (Given that for  $n=5$ ,  $A_2=0.577$ ,  $D_4=2.115$ ,  $D_3=0$  and for  $n=6$ ,  $A_2=0.483$ ,  $D_3=0$ ,  $D_4=2.004$ )

4. Answer **any three** of the following questions : 10×3=30

- (a) What are the advantages of statistical quality control ? Also explain the justification for using three sigma ( $3\sigma$ ) limits in the control charts.
- (b) Explain in detail  $\bar{X}$  and R-charts. What purpose do they serve ? What are their advantages over the p-chart ?
- (c) What is C-chart ? How are the control limits for C-chart obtained ? Justify the use of Poisson distribution.
- (d) Describe the single sampling plan for acceptance sampling deriving expressions for the producer's and consumer's risks and show that

$$ATI = n + (N - n) \left[ 1 - \sum_{x=0}^c \frac{e^{-n\bar{P}} (n\bar{P})^x}{x!} \right]$$

- (e) Describe the method of double sampling plan and derive its OC curve.
- (f) Describe seven tools of statistical process control (SPC).



- (g) What do you mean by quality ?  
Describe different dimensions of quality.
- (h) Explain the terms :  $4+4+2=10$
- (i) Average outgoing quality limit
  - (ii) Specification limits
  - (iii) Why are ASN and ATI calculated ?

