

V Semester

Class : III UG
Major : Mathematics

Time :3 hours
Max. Marks: 100

15BMAC16 Statistical Quality Control

Part-A

10 x 1=10

Choose the correct answer

- The range of the allowable variation is known as the _____
a. stable pattern
b. assignable cause
c. natural tolerance
d. abnormal tolerance
- If t is the underlying statistic, then $LCL =$ _____
a. $E(t) + S.E.(t)$
b. $E(t) - S.E.(t)$
c. $E(t) + 3 S.E.(t)$
d. $E(t) - 3 S.E.(t)$
- The $3\text{-}\sigma$ control limits for R-chart is given by _____
a. $E(R) + 3\sigma_R$
b. $E(R) - 3\sigma_R$
c. $E(R) \pm 3\sigma_R$
d. $E(R) + 3 S.E.(t)$
- The average of sample means is given by _____
a. $\bar{X} = \frac{1}{k} \sum \bar{X}_i$
b. $\bar{X}_i = \frac{1}{k} \sum X_{ij}$
c. $\bar{s} = \frac{1}{k} \sum s_i$
d. $\bar{X} = \frac{1}{k} \sum (X_{ij} - \bar{X}_i)^2$
- The control chart for fraction defective is _____
a. np-chart
b. p-chart
c. d-chart
d. R-chart
- The points outside the UCL are termed as _____
a. high spots
b. low spots
c. middle spots
d. outer spots
- The natural tolerance limits are given by _____
a. $\mu + 3\sigma$
b. $\mu - 3\sigma$
c. $3\mu + \sigma$
d. $\mu \pm 3\sigma$
- The lower edge of the central band is given by _____
a. $LSL - 3\sigma$
b. $LSL + 3\sigma$
c. $USL + 3\sigma$
d. $USL - 3\sigma$
- ATI means _____
a. average total inspection
b. average total index
c. average tolerance index
d. average tolerance inspection
- AOQ is equal to _____
a. $\frac{p(N-n)P_a}{N}$
b. $\frac{p(N-n)}{N}$
c. $\frac{(N-n)P_a}{n}$
d. $p(N-n)P_a$

Part B

Answer the following
Answer should not exceed 400 words or two pages

- 11.a. Explain about the chance and assignable causes of variation.
(or)
- 11.b. Discuss on the tools for S.Q.C.
- 12.a. Derive the control limits for R-chart.
(or)
- 12.b. If the r^{th} sample mean is the first to exceed UCL, show that $E(r) = \frac{1}{P_n}$.
- 13.a. Explain about the control chart for number of defectives.
(or)
- 13.b. Discuss shortly about the interpretations of p-chart.
- 14.a. What are the applications of c-chart ?
(or)
- 14.b. Explain briefly the terms (i) natural tolerance limits and (ii) specification limits.
- 15.a. What are meant by AQL and AOQL ?
(or)
- 15.b. Explain the following terms : (i) Consumer's risk and (ii) Producer's risk.

Part C

5 x 12=60

Answer the following
Answer should not exceed 800 words or four pages

- 16.a. Discuss in detail about the uses of S.Q.C.
(or)
- 16.b. Explain about control charts and $3-\sigma$ control limits
- 17.a. Discuss in detail about the criterion for detecting lack of control in \bar{X} and R-charts.
(or)
- 17.b. p_n is the probability of the mean of a sample size of size n falling outside the control limits. Show that
(i) the probability that at most x samples are to be taken for r points to go out of control is
- $$1 - \sum_{s=0}^{r-1} [{}_x C_s p_n^s (1-p_n)^{x-s}]$$
- (ii) the probability that exactly x samples are to be taken for r points to go out of control is
- $$\left(\frac{p_n}{1-p_n} \right)^r {}_{x-1} C_{r-1} (1-p_n)^x, \quad x \geq r$$
- 18.a. Explain in detail about p-chart when (i) the standards are given and (ii) the standards are not given.
(or)
- 18.b. The following are the figures of defectives in 22 lots each containing 2000 rubber belts:
425, 430, 216, 341, 225, 322, 280, 306, 337, 305, 356,
402, 216, 264, 126, 409, 193, 326, 280, 389, 451, 420.
Draw control chart for fraction defective and comment on the state of control of the process.
- 19.a. Derive the limits for c-chart.
(or)
- 19.b. Explain in detail about modified control limits.
- 20.a. From a lot consisting of 2200 items, a sample of size 225 is taken. If it contains 14 or less defectives, the lot is accepted otherwise rejected. Plot the OC, ATI and AOQ curves. Also obtain the value of AOQL.
(or)
- 20.b. (i) Plot the operating characteristic curves for Single Sampling Plan where $N = 5000$, $n=100$, $c=1,2,3$. Assuming $P_c = 0.10$, determine the lot tolerance fraction defective.
(ii) For the above data, plot the average outgoing quality curve and determine AOQL.