CBCS SCHEME

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18IM53

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Quality Assurance and Reliability

Time: 3 hrs. Max. Marks: 100

Note: **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Statistical tables is permitted.***

Module-1

1 a. Explain the eight dimensions of quality. **(10 Marks)**

b. Explain chance causes and assignable causes of variation with examples. **(10 Marks)**

OR

2 a. Explain four categories of quality cost with examples. **(10 Marks)**

b. Explain 7 QC tools with neat sketch. **(10 Marks)**

Module-2

3 a. Subgroup of 5 items each are taken from a manufacturing process at regular intervals. A certain quality characteristics is measured and $\overline{X}$, R values computed for each subgroup. After 25 subgroup $\Sigma\overline{X} = 357.5$, $\Sigma R = 8.8$. Assume that all the points are within the control limits on both the charts. The specification are 14.4 ± 0.4.

i) Compute the control limits for $\overline{X}$ and R chart.
ii) What is process capability?
iii) Determine the percentage of rejections any.
iv) What can you conclude regarding its ability to meet the specifications?
v) Suggest the possible ways for improving the situation. **(12 Marks)**

b. The inspection results in a machine shop based on sampling size of 50 are given in Table.Q3(b).

Sample No.	Number of Defectives	Sample No.	Number of Defectives
1	6	11	3
2	3	12	7
3	1	13	1
4	2	14	15
5	12	15	4
6	6	16	18
7	4	17	3
8	7	18	2
9	1	19	6
10	8	20	7

Table.Q3(b)

(i) Calculate the control limits for P-chart using 3σ limits.
(ii) Plot the data and offer your comments on the behaviour of the process.
(iii) What standard fraction defective would you recommend for future period? **(08 Marks)**

OR

4 a. The following are $\overline{X}$ - R values of 20 subgroups of 5 readings as shown in Table.Q4(a).

Subgroup No.	$\overline{X}$	R	Subgroup No.	$\overline{X}$	R
1	34.0	4	11	38.4	4
2	31.6	2	12	34.0	14
3	30.8	3	13	35.0	4
4	33.8	5	14	33.8	7
5	31.6	2	15	31.6	5
6	33.0	5	16	33.0	7
7	28.2	13	17	32.6	3
8	33.8	19	18	31.8	9
9	37.8	6	19	35.6	6
10	35.8	4	20	33.0	4

Table.Q4(a)

i) Determine the control limits for $\overline{X}$ and R chart.
ii) Construct the $\overline{X}$ and R chart and interpretate the result.
iii) What is process capability?
iv) Does it appear that the process is capable of meeting the specification limits?
v) Determine the percentage of rejection if any.

The specification limits are 33± **(12 Marks)**

b. A manufacturer uses an injection moulding to produce a plastic insulation barrier. He inspects 100 barriers daily picked randomly from the production and determines the number of defectives by visual inspection. He wishes to use the data accumulated during a 10 days period to construct an attribute chart. The results of inspection are shown in below Table.Q4(b).

Lot number	1	2	3	4	5	6	7	8	9	10
No. of items rejected	6	14	18	10	2	20	18	5	12	8

Table.Q4(b)

(i) Plot np chart and offer your comments.
(ii) What control limits would you recommend for the future period? **(08 Marks)**

Module-3

5 a. Explain double sampling plan with neat flow diagram. **(08 Marks)**

b. A single sampling plan is as follows: N = 5000, n = 80, c = 2
(i) Plot the OC curve for the above plan.
(ii) What is the producer's risk if AQL is 1.5%?
(iii) What is the consumer's risk if LTPD is 4.5%? **(12 Marks)**

OR

6 a. List the advantages and disadvantages of sampling plan compared with 100% inspection. **(04 Marks)**

b. Explain the following terms with the help of operating characteristic curve (OC curve):
(i) AQL (ii) LTPD (iii) Producer's risk (iv) Consumer's risk **(06 Marks)**

c. A double sampling plan is as follows:
N = 3000, $n_1 = 55$, $n_2 = 120$, $c_1 = 0$, $c_2 = 2$, $100P' = 1$, $P' = 0.01$
Calculate P_a, ATI, AOQ and ASN. **(10 Marks)**

Module-4

7 a. Write a brief note on use of statistical method of tolerancing. **(06 Marks)**

b. Dimensions of two mating parts E and F are normally distributed with averages of 251.0 mm and 250.0 mm and standard deviations of 0.1 mm and 0.3 mm respectively. If the parts are assembled randomly, what percent of the assemblies will have

i) Clearance greater than 1.2 mm

ii) No defective parts if the specifications E and F are 215.0 ± 0.2 mm and 250.0 ± 0.5 mm respectively. **(14 Marks)**

OR

8 a. Distinguish clearly between accuracy and precision. **(05 Marks)**

b. Define the following terms: (i) Repeatability (ii) Reproducibility **(05 Marks)**

c. Control chart analysis indicates that this standard deviation of the distribution of dimensions of the two mating parts C and D are 0.008 mm and 0.02 mm respectively. It is desired that the probability of a smaller clearance than 0.02 mm should be 0.05. What distance between the average dimensions of C and D should be specified? What is the probability that 2 parts assembled at random will have a greater clearance than 0.012 mm? Assume normal distribution and random assembly. **(10 Marks)**

Module-5

9 a. What do you mean by the following terms related to reliability:
(i) MTBF (ii) MTTF (iii) Mean life (iv) Failure rate (v) Redundancy **(05 Marks)**

b. A device has a failure rate of 5×10^{-6} failures/hour.

(i) What is the reliability for an operating period of 100 hours?

(ii) If 10,000 items are placed in the test, how many failures are expcted in 100 hours?

(iii) What is the MTBF?

(iv) What is the reliability of the system when operating time = MTBF?

(v) If the useful life is 1 lakh hours, what is the reliability for operating over its useful life? **(10 Marks)**

c. An electronic system consists of power supply whose failure rate is 30 failures/10^6 hours. A receiver whose failure rate is 25 failures/10^6 hours and an amplifier whose failure rate is 20 failure/10^6 hours in series. The equipment is to operate for 200 hours. Determine its reliability. **(05 Marks)**

OR

10 a. Explain failure rate curve or bath tub curve with a neat sketch. **(10 Marks)**

b. Determine the reliability and MTBF of the system for 10 hours operating period. The system has five components in series with constant failure rate of 3.00, 1.65, 2.00, 1.40 and 1.70 failures per 1000 hours respectively. **(10 Marks)**

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