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10ME668

Sixth Semester B.E. Degree Examination, June/July 2019
Statistical Quality Control

Time: 3 hrs.

Max. Marks:100

Note: 1. Answer any FIVE full questions, selecting at least TWO full questions from each part.
2. Statistical Tables are permitted.

PART – A

- 1 a. Define Quality. Discuss dimensions of quality. (06 Marks)
 b. Define cost of Quality. Explain with example categories of cost of Quality. (08 Marks)
 c. Explain term TQM. Discuss different principles. (06 Marks)
- 2 a. Explain salient features of normal curve. (04 Marks)
 b. Discuss in brief Deming's Funnel experiment. (08 Marks)
 c. The mean value of modulus of rupture of large number of test specimens has been found to be 5600 psi. If the standard deviation is 840psi and distribution is approximated to be normal.
 i) What percentage of specimen will have modulus of rupture within 5600 and 6200psi?
 ii) What percentage of it will be above 4000psi and below 3500psi? (08 Marks)
- 3 a. Define control chart. Explain significance and objectives of control chart. (06 Marks)
 b. Explain concept of
 i) Average Run Length (ARL)
 ii) Warning Limits (06 Marks)
 c. Explain analysis of pattern of variation on control chart. (08 Marks)
- 4 a. Explain guidelines of Design for control chart. Discuss objectives of \bar{X} , R chart. (08 Marks)
 b. Following data are obtained over a 10 day period to initiate \bar{X} , R charts. Control charts for a quality characteristics of a certain product that had required a substantial amount of rework. Subgroup size is 5. 2 subgroups were taken per day.

Sub group No.	\bar{X}	R	Sub group No.	\bar{X}	R
1	177.6	23	11	179.8	9
2	177.6	8	12	176.4	8
3	178.4	22	13	178.4	7
4	176.6	12	14	178.2	4
5	177.0	7	15	180.6	6
6	179.4	8	16	179.6	10
7	178.6	15	17	177.8	9
8	178.8	6	18	178.4	7
9	178.2	7	19	181.6	10
10	179.6	12	20	177.6	6

- i) Determine trial control limits for \bar{X} , R chart.
- ii) Plot \bar{X} , R chart comment on process. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – B

- 5 a. Briefly explain C_p and C_{pk} . (04 Marks)
- b. A certain product has a specification of 120 ± 5 . At present the estimated process average is 120 and $\sigma' = 1.5$.
- i) Compute 3σ limits for \bar{X} , R chart based on subgroup of 4.
- ii) If there is shift in process average by 2% what percentage of products will fail to meet specification? (10 Marks)
- c. Consider two processes, sample size $n = 5$.

	Process M	Process N
Average	50	52
Std. Dev.	1.5	0.5

Specifications are set at 50 ± 5 . Calculate C_p and C_{pk} which process is preferred comment.

(06 Marks)

- 6 a. Discuss limitations of control chart for variables. (04 Marks)
- b. The inspection results in a machine shop based on sample size of 50 are given below:
- i) Determine trial control limits.
- ii) Plot the data and comment on the process.
- iii) What standard fraction defective would be recommended for future period?

Sample number	Number of defectives	Sample number	Number of defectives	Sample number	Number of defectives
1	6	8	7	15	4
2	3	9	1	16	18
3	1	10	8	17	3
4	2	11	3	18	2
5	12	12	7	19	6
6	6	13	1	20	7
7	4	14	15		

(10 Marks)

- c. The following data refers to the number of missing rivets on an aircraft body noticed during preventive maintenance schedule. Compute control limit and plot data. Comment.

Air craft number	No. of missing rivets	Aircraft number	Number of missing rivets
1	8	9	21
2	15	10	13
3	15	11	21
4	19	12	16
5	9	14	09
6	15	14	23
7	9	15	15
8	12		

(06 Marks)

- 7 a. Sketch OC curve and explain the characteristics. (04 Marks)
- b. A single sampling plan is as follows: $N = 5000$, $n = 80$, $C = 2$. Plot OC curve for the plan. Determine producer's risk if AQL is 1.5% and consumer risk if LTPD is 4.5%. (10 Marks)
- c. Draw a flow chart for double sampling plan. (06 Marks)
- 8 a. Briefly explain principles of construction of cumulative sum control chart for monitoring the process mean. (10 Marks)
- b. Write note on:
- i) Design of EWMA control chart.
- ii) Sequential sampling plan. (10 Marks)
