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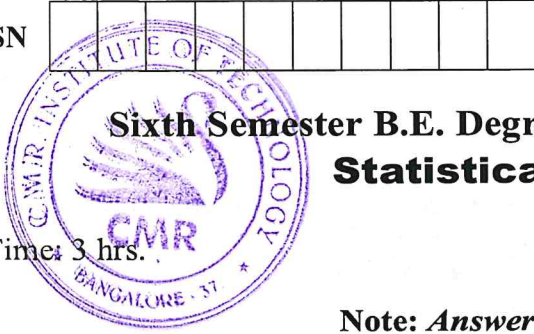**Sixth Semester B.E. Degree Examination, July/August 2021**
Statistical Quality Control

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions.*

1 a. Define the term quality. Explain the dimensions of quality with an example. **(08 Marks)**
   b. Explain the following as applied to quality costs:
      (i) Appraisal costs
      (ii) Prevention costs
      (iii) Failure costs. **(12 Marks)**

2 a. Explain the following:
      (i) Normal distribution curve
      (ii) Central limit theorem. **(06 Marks)**
   b. Explain the relationship between mean and standard deviation. **(04 Marks)**
   c. In a deviation exactly normal 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution? **(10 Marks)**

3 a. Differentiate between chance causes and assignable causes of variations. **(04 Marks)**
   b. Explain the following:
      (i)   Process capability.
      (ii)   Rational subgrouping.
      (iii) Significance of control charts.
      (iv)   Interpretation of $\overline{X}$ and R charts. **(16 Marks)**

4 a. Explain Type I and Type II errors. **(04 Marks)**
   b. $\overline{X}$ and R charts are used to control a process by drawing subgroups of 5 units. Specification limits are 2119 ± 10.0. Product over specification may be reworked, if undersized, it must be scrapped. After 50 subgroups, $\sum \overline{X} = 106200$ and $\sum R = 581.5$.
      (i) Determine 3-sigma control limits for $\overline{X}$ and R charts.
      (ii) Assuming the process is in control and normally distributed, estimate the value of σ' and determine the percent of product that must be reworked and scrapped. **(16 Marks)**

5 a. Explain briefly C_P and C_{PK}. **(06 Marks)**
   b. Control charts for $\overline{X}$ and σ are maintained for the resistance in ohms of certain electrical parts. The subgroup size is 25. The values of $\overline{X}$ and σ are computed for each subgroup. After 20 subgroups $\sum \overline{X} = 1612.9$ and $\sum \sigma = 71.4$. Compute the values of 3σ limits for $\overline{X}$ and σ charts and estimate the value of σ' on the assumption that the process is in statistical control. **(14 Marks)**

6 a. Distinguish between:
   (i) Defect and defective.
   (ii) P chart and C chart.
   (iii) u chart and C chart. **(06 Marks)**

b. The following table indicates inspection results of certain product based on the sample size of 50. Construct a suitable chart and offer your comments.

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

(14 Marks)

7 a. With the help of OC curve, explain the following terms:
   (i) AQL
   (ii) LTPD
   (iii) AOQL
   (iv) Producer's risk.
   (v) Consumer's risk. **(10 Marks)**

b. A single sampling plan has, $n = 110$, $C = 3$. The lot size is large compared to sample size. Plot the OC curve and find the values for LTPD for which the probability of acceptance are 0.95, 0.50 and 0.10 respectively. **(10 Marks)**

8 a. Explain the basic principles of construction of CUSUM control charts. **(10 Marks)**

b. Briefly explain the elements that are required to design an EWMA control chart. **(10 Marks)**

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