Sixth Semester B.E. Degree Examination, June/July 2016
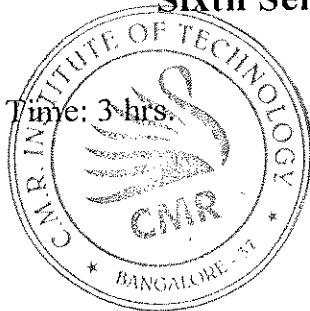## Statistical Quality Control

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting*
at least TWO questions from each part.
2. Use of SQC tables allowed,
3. Missing data if any may be suitably assumed.

PART – A

1   a. Define quality and indicate dimensions of quality.   (04 Marks)
    b. List the 7Q.C tools and explain with proper graph any 4.   (10 Marks)
    c. Define TQM and explain the basic concepts of TQM.   (06 Marks)

2   a. Define arithmetic mean, median, mode, standard deviation.   (04 Marks)
    b. Explain with necessary sketches rules of Deming Funnel experiment and the conclusion.
                                                                                    (06 Marks)
    c. Assuming that the life in hours of an-electric bulb is a random variable following normal distribution with mean of 2000hrs and standard deviation of 400hours. Find the expected number of bulbs from a random sample of 2000 bulbs having life.   (06 Marks)
        i) More than 3000 hours   ii)   Between 2600 and 2800 hrs.
    d. A normal curve has an average of 140.6 and a standard deviation of 3.70. What % of area under the curve will fall between limits of 135.5 and 142.5? Shows it on the graph?
                                                                                    (04 Marks)

3   a. With examples explain the differences between chance and assignable causes.   (06 Marks)
    b. What are control limits and explain its significance with necessary charts.   (04 Marks)
    c. With necessary graphs, explain the 5 different patterns of control charts and its significance. What is the necessity of warning limits?   (10 Marks)

4   a. What are Type I and Type II errors? Explain.   (04 Marks)
    b. Construct control chart for $\overline{X}$ and R for the following data on the basis of samples of fuses, 5 being taken every hour. Comment on state of control.   (08 Marks)

Sub group	Sample observation					Sub group	Sample observation				
1	42	65	75	78	87	7	60	60	72	95	138
2	42	45	68	72	90	8	18	20	27	42	60
3	19	24	80	81	81	9	15	30	39	62	84
4	36	54	69	77	84	10	69	109	113	118	153
5	42	51	57	59	78	11	64	90	93	109	112
6	51	74	75	78	132	12	61	78	94	109	136

    c. The mean weight of large loaf produced at bakery was found in a series of quality control checks to be 30 ounces, with a standard deviation of 10 ounce. Sample batches of 4 loaves were taken from the travelling oven at 2 hourly intervals and the following are the averages of the last 6 consecutive subgroup batches :
        29.6, 29.4, 29.9, 30.2, 30.3, 30.1.
        i)   Draw the control chart for averages and enter figure on the chart and comment
        ii) What proportions of loaves would you expect to fall below the legal minimum weight of 28 ounces?   (08 Marks)

PART – B

5 a. How do you evaluate C_p and C_{pk} and discuss the importance of process capability. **(06 Marks)**

   b. Determine the control limits for $\overline{X}$ and R charts, if $\sum \overline{X} = 357.50$ and $\sum R = 9.90$, number of subgroups = 20. It is given that $A_2 = 0.18$, $D_3 = 0.41$, $D_4 = 1.59$ and $d_2 = 3.735$ Also, find the process capability. **(06 Marks)**

   c. In a capability study of the lathe used in turning a shaft to a diameter of 23.75 ± 0.1 mm, a sample of 6 consecutive pieces was taken each day for 8 days. The compilation of data shows $\sum \overline{X} = 190.1567$ and $\sum R = 0.54$, $d_2 = 2.534$ for 6 samples from table. Find the process capability and comment on the process. **(08 Marks)**

6 a. Discuss Binomial distribution and Poisson distribution and its application. **(06 Marks)**

   b. Inspection in drop hammer department of sheet metal part has defects as detailed below

Production order No	Lot size 'n'	Number of rejects
1	200	4
2	200	8
3	200	2
4	200	6
5	200	4
6	200	4
7	200	10
8	200	6
9	200	4
10	200	8

Draw an appropriate chart and comment on the process. **(06 Marks)**

   c. The following table gives the number of errors of alignment observed at final inspection of a certain model of aeroplane. Prepare the necessary chart and comment on the picture revealed by chart.

Aeroplane No	Alignment errors	Aeroplane No	Alignment errors	Aeroplane No	Alignment errors
201	7	210	9	219	13
202	6	211	8	220	7
203	6	212	5	221	8
204	7	213	5	222	15
205	4	214	9	223	6
206	7	215	8	224	6
207	8	216	15	225	10
208	12	217	6		
209	9	218	4		

(08 Marks)

7 a. Explain single sampling, double, multiple and sequential sampling. **(08 Marks)**

   b. With a graph show AOQ and AOQL and discuss its significance. **(06 Marks)**

   c. A single sampling plan is given as n = 100 and c = 3. The lot size is large in comparison with sample size. Compute the approximate probability of acceptance of lots with 1% defective (use Poisson). Probability of ≤ 3 defectives = 0.981.

   i) Determine the AOQ value for the above lots.

   ii) What will be the average inspection in percent (Assume acceptance, rectification plan) of 100 lots? **(06 Marks)**

8 Write short notes on :

   a. CUSUM control chart b. EWMA control chart

   c. Natural tolerance limit d. MIL/O5E. **(20 Marks)**

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