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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Seventh Semester, B.E. - Automobile Engineering

Make-up Examination; Jan / Feb - 2017

Statistical Quality Control

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Use of SQC table is permitted.

UNIT - I

1 a. Explain the different quality costs for carrying out quality functions. 9

b. What are the objectives of quality control? 5

c. Explain briefly the quality characteristics. 6

2 a. What is quality of design? What are the factors controlling quality of design? 8

b. Define SQC. Discuss the benefits of SQC. 7

c. Discuss briefly the concepts of quality management. 5

UNIT - II

3.a A typical data on diameter measurements of pins in mm is given below,

i) Draw the frequency histogram ii) Draw the ogive curves,

less than the class upper boundary and more than the class lower boundary

Class boundaries	Class mark	Frequency
25.65 - 25.85	25.75	1
25.45 - 25.65	25.55	7
25.25-25.45	25.35	18
25.05 - 25.25	25.15	14
24.85 - 25.05	24.95	8
24.65 - 24.85	24.75	2

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b. A machine shop produces steal pins, the width of 100 pins was cheeked after machining and data was recorded as follows,

Width in mm	Frequency	Width in mm	Frequency
9.50 - 9.51	6	9.58-9.59	22
9.52 - 9.53	2	9.60-9.61	8
9.54 - 9.55	20	9.62-9.63	6
9.56 - 9.57	32	9.64-9.65	4

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i) Find the arithmetic mean, standard deviation and variance

ii) What percentage of the pins manufactured has width of 9.52 to 9.63?

Contd…2

4 a. What are the main characteristics of normal distribution? 4

b. The time taken to complete a particular respective job is normally distributed with a mean of 40 minutes and standard deviation of 8 minutes, 25 jobs are to be performed,

i) How many jobs are expected to take more than 48 minutes?

ii) How many jobs are expected to be completed within 35 minutes? 10

iii) What is expected total number of jobs that can be completed between 20 and 50 minutes?

c. A lot of 25 articles contains 3 defective. A sample of 5 is selected at randam from the lot for inspection. What are the respective probalities of 0, 1, 2 and 3 defective occuring in the sample of 5? 6

UNIT - III

5. A machine is working to a specification of 12.58 ± 0.05 mm. A study of 50 consecutive pieces shows the following measurement put in to 10 groups of 5 each.

12.62	12.63	12.62	12.61	12.59	12.57	12.57	12.58	12.61	12.56
12.70	12.56	12.56	12.66	12.58	12.63	12.56	12.57	12.60	12.59
12.62	12.60	12.57	12.62	12.57	12.60	12.61	12.60	12.62	12.62
12.61	12.59	12.58	12.61	12.59	12.60	12.59	12.60	12.60	12.58
12.65	12.60	12.63	12.60	12.56	12.59	12.59	12.61	12.65	12.54

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i) Determine the process capability

ii) Determine the 3σ limits for $\bar{x}$ chart

iii) Does it appear that the machine is capable of meeting the specification requirements?

iv) Suggest possible ways by which the percent defective can be reduced .Assume normal distribution, "d_2" for sub graph size "5" is 2.326.

6 a. What are type I and type II errors? 4

b. Control charts for $\overline{X}$ and R are maintained on a certain dimension of a manufactured part which is specified as 2.050 ± 0.020 cm the subgroup size is 4 the values of $\overline{X}$ and R are computed for each subgroup. After 20 sub groups , $\varepsilon_{\bar{x}} = 41.283$, $\varepsilon_R = 0.280$;

i) Compute 3σ control limits for $\overline{X}$ and R charts 16

ii) If the dimensions falls above 'U' rework is required, if below 'L' the part must be scrapped. If the process is in statistical control and normally distributed, what can you conclude regarding its ability to meet specifications. Can you make any suggestions for improvement?

Contd…3

UNIT - IV

7 a. Differentiate between a defeat and defective. 4

b. The management is intended to know the quality level of cylinder blocks cast continuously in a foundry shop. A random sample of 50 blocks is taken from each day production and inspected. This is continued for 30 days, the observations are given in the table below. Determine the control limits for use in future production. 16

Date	No. of Rejections	Date	No. of Rejections
1	5	16	12
2	10	17	9
3	12	18	15
4	14	19	21
5	31	20	24
6	27	21	16
7	14	22	10
8	9	23	9
9	24	24	16
10	33		
11	26		
12	19		
13	13		
14	5		
15	4		

8 a. Compare Attribute Charts and Variable Charts. 5

b. The following table gives the number of missing rivets noted at aircraft final inspection. 15

Date	No. of Missing rivets	Date	No. of Missing rivets
1	8	14	25
2	16	15	15
3	14	16	9
4	19	17	9
5	11	18	14
6	15	19	11
7	8	20	9
8	11	21	10
9	21	22	22
10	12	23	7
11	23	24	28
12	16	25	9
13	9		

Find $\overline{C}$, compute trial control limits and plot control chart for C. What values of $\overline{C}$ would you suggest for the subsequent period?

Contd…4

UNIT - V

9 a.	Explain different parameters that affect the OC curve.	5
b.	Draw an OC curve for the single sampling plan N = 1000, n = 120, C = 2, AQL = 4%, L_TP_D = 8%. Find producers risk (α) and consumers risk (β).	15
10 a.	Draw the flow chart for a double sampling plan	5
b.	In a double sampling plan, N = 5000, n_1= 100, C_1 = 0, n_2 = 100, c_2 = 1; i) Use Poisson table to compute the probability of acceptance of a 1% defective lot ii) Assume that a lot rejected by this sampling plan will be 100% inspected. What will be the AOQ, if the submitted product is 1% defective? Considering both the inspection of rejected lots, what will be the average number of articles inspected per lot, if the submitted product is 1% defective?	15

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