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

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester – B.E., Mechanical Engineering

Semester End Examination; June - 2016

Statistical Quality Control

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*
ii) Missing data may suitably assume.
iii) SQC Table is permitted.

UNIT - I

1 a. Define Quality from producer and consumer concept with an example. 5

b. Taking the specific product 'Mobile', list and discuss how the eight dimensions of quality impact its overall acceptance of consumer. 15

2 a. Explain the factors controlling quality of design and quality of conformance. 12

b. Define quality control and explain the objectives of quality control. 8

UNIT - II

3 a. Differentiate between chance causes and assignable causes of variation with example. 8

b. A machine shop produces steel pins. The width of 100 pins was checked after machining and data was recorded as follows given in Table (3b). 12

Table(3b)

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

i) find the Arithmetic mean, standard deviation and variance

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

4 a. Explain the characteristics of Normal distribution curve. 8

b. Assuming that the life in hours of an Electric bulb is a random variable that follows normal distribution with mean of 2000 hours and standard deviation of deviation of 400 hours. Find the expected number of bulbs from a random sample of 2000 having life. 12

(i) More than 3000 hours

(ii) Between 2600 and 2800 hours

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UNIT - III

5 a. Explain : 8

(i) sample and population (ii) Rational sub grouping

b. In a capability study to Lathe used in turning a shaft to a diameter of 23.75 ± 0.1 mm a sample of a 6 consecutive pieces was taken each day for 8 days. The diameters of these shafts are as given in the table 5(b). Construct the $\overline{X}$ and R chart and find out the process capability for machine 12

Table 5(b)

1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day
23.77	23.80	23.77	23.79	23.75	23.78	23.76	23.76
23.80	23.78	23.78	23.76	23.78	23.76	23.78	23.79
23.78	23.76	23.77	23.79	23.78	23.73	23.75	23.77
23.73	23.70	23.77	23.74	23.77	23.76	23.76	23.72
23.76	23.81	23.80	23.82	23.76	23.74	23.81	23.78
23.75	23.77	23.74	23.76	23.79	23.78	23.80	23.78

6 a. What do you mean by process capability and process capability index and explain how these two are estimated. 8

b. Food served at a restaurant should be between 38ºC and 49ºC when it is delivered to the customer. The process used to keep the food at the correct temperature has a process standard deviation of 2ºC and the mean value for these temperatures is 40.what is the process capability of the process? And also calculate the process capability index and infer your solution. 12

UNIT - IV

7 a. Differentiate between defects and defective with example. 6

b. In a manufacturing process the number of defectives found in the inspection of 20 lots of 100 samples is given below in Table 7(b) (i) Determine the control limits of P chart and state whether the process is in control. (ii) Determine the new value of mean fraction defective if some points are out of control. Compute the corresponding control limits and state whether the process is still in control or not. (iii) Determine the sample size when a quality limit not worse than 9% is desirable and a 10% bad product will not be permitted more than three times in thousand. 14

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Table 7(b)

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

8 a. Discuss the area of application of control chart for defective and defects. 8

b. Five different types of defects are classified in a telephone assembly industry. The weightage to each defect is as shown in Table 8(b). A sample of 20 units is inspected and number of defects of each class is recorded as follows: Establish the central line, upper control limit and lower control limit for demerit control chart. 12

Table 8(b)

Class of Defects	Weightage (W_i)	No. of Defects (Σ_{ci})
1	0.80	4
2	0.65	12
3	0.25	60
4	0.15	75
5	0.05	50

UNIT - V

9 a. Explain producer risk and consumer risk. 8

b. A single sampling plan is given as N = 10,000, n = 100 and C = 2

(i) Compute with approximate probability of acceptance of lots with 1% defective (use Poisson) 12

(ii) Determine the AOQ value for the above lots

(iii) What will be the average inspection in percent? (Assume acceptance rectification plan)

10 a. State and explain the advantages and limitations of acceptance sampling over 100% inspection. 6

b Design a sequential sampling plan for the following Specification:

$\alpha = 0.05$ $P_1 = 0.10$

$\beta = 0.20$ $P_2 = 0.30$ 14

Contd….4

Compute (i) Average outgoing quality when $P^1=P_1$

(ii) Minimum number of items inspected for accepting the lot.

(iii) Minimum number of defectives for rejection of the lot

(iv) Average number of items inspected when the quality of the lot is P_1

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