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**Reg. No. :**

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**Question Paper Code:U7007**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Professional Elective

Mechanical Engineering

21MEV1007 STATISTICAL QUALITY CONTROL

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. DMAIC stands for CO1-U
  - (a) Do-Measure-Act-Implement-Check
  - (b) Define-Measure-Analyze-Improve-Control
  - (c) Define-Measure-Act-Implement-Control
  - (d) Do-Measure-Analyze-Improve-Control
2. The most important measure of central tendency in a sample is CO1-U
  - (a) Sample Average
  - (b) Sample variance
  - (c) Frequency of highest observation
  - (d) Frequency of lowest observation
3. Which of these is not a part of SPC's 7 tools? CO1-U
  - (a) Pareto chart
  - (b) Histogram
  - (c) Design of Experiments
  - (d) Check sheet
4. The standard deviation of the sampling distribution of the sample mean is also called CO1-U
  - (a) central limit theorem
  - (b) standard error of the mean
  - (c) finite population correction factor
  - (d) population standard deviation
5. Which among the following is a type of control chart for variables? CO1-U
  - (a) C chart
  - (b) p chart
  - (c) X bar chart
  - (d) u chart

6. When the process capability  $6\sigma$  is less than the specified tolerance the rejections are CO1-U  
 (a) very high (b) less (c) high (d) nil
7. If a lower control limit of a p chart has negative value it is CO1-U  
 (a) eliminated from the chart (b) treated as negative only  
 (c) equated to zero (d) none of the above
8. The control chart for number of defects per sample is CO1-U  
 (a) p chart (b) u chart (c) np chart (d) C chart
9. In a sampling plan N indicates CO1-U  
 (a) Sample size (b) Lot size (c) Rejection number (d) Acceptance number
10. The maximum percent defective that the consumer finds definitely acceptable is called as CO1-U  
 (a) AOQL (b) LTPD (c) AQL (d) AOQ

PART – B (5 x 2= 10Marks)

11. Explain the term quality. CO1-U
12. The points scored by a Kabaddi team in a series of matches are as follows: 17, 2, 7, 27, 15, 5, 14, 8, 10, 24, 48, 10, 8, 7, 18, 28. Find the mean, median and mode of the points scored by the team CO2 App
13. Discuss the necessity for variable control charts. CO1-U
14. Explain process capability analysis. CO1-U
15. Outline any two advantages of acceptance sampling. CO1-U

PART – C (5 x 16= 80Marks)

16. (a) Summarize the Deming's 14 points in Total Quality Management CO1-U (16)  
 Or  
 (b) Explain the seven major SPC problem solving tools used in the organization. CO1-U (16)

17. (a) A machine produces steel pins. The width of 100 pins was checked after machining and data was recorded as follows: CO2 App (16)

Width (mm)	9.50- 9.51	9.52- 8.53	9.54- 9.55	9.56- 9.57
Frequency	6	2	20	32
Resistance (Ohms)	9.58- 9.59	9.60- 9.61	9.62- 9.63	9.64- 9.65
Width (mm)	22	8	6	4

Find the arithmetic mean, standard deviation and variance.

Or

- (b) Assuming that the life in hours of an electric bulb is a random variable following normal distribution with mean of 2000 hours and standard deviation of 400 hours. Find the expected number of bulbs from a random sample of 2000 bulbs having life (i) more than 3000 hours and (ii) between 2600 and 2800 hours. CO2 App (16)
18. (a) Develop the control limits for  $\bar{X}$  and R charts if  $\sum X = 357.50$ ,  $\sum R = 9.90$  and 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. CO3 App (16)

Or

- (b) Sub groups of 4 items each are taken from a manufacturing process at regular intervals. A certain quality characteristic is measured and  $\bar{X}$  and R values are computed for each sub group. After 25 subgroups,  $\sum \bar{X} = 15,350$  and  $\sum R = 411.4$ . Identify and compute the limits for the control charts and estimate the value of  $\sigma$  on the assumption that the process is in statistical control. CO3 App (16)
19. (a) A manufacturer purchases small bolts in cartons that usually contains several thousand bolts. Each shipment consists of a number of cartons. As a part of the acceptance procedure for these bolts, 400 bolts are selected at random from each carton and are subjected to visual inspection for certain defects. In a shipment of 10 cartons the respective percentages of defectives in the samples from each carton are 0, 0, 0.5, 0.75, 0, 2.0, 0.25, 0, 0.25 and 1.25. Does this shipment of bolts appear to exhibit statistical control with respect to the quality characteristics examined in the inspection? CO3 App (16)

Or

- (b) The emergency service unit in a hospital has a goal of 3.5 min for the waiting time of patients before being treated. A random sample of 20 patients is chosen and the sample average waiting time is found to be 2.3 min with a sample standard deviation of 0.5 min. Find an appropriate Process capability index. Comment on the ability of emergency service unit to meet the desirable goal. CO3 App (16)
20. (a) The lot size  $N$  is 2000 in a certain AOQL inspection procedure. The desired AOQL of 2% can be obtained with any one of the three sampling plans. These are: CO3 App (5)
- (i)  $N = 65$  and  $c = 2$  (5)
  - (ii)  $N = 41$  and  $c = 1$  (6)
  - (iii)  $N = 18$  and  $c = 0$
- If a large number of lot 0.3% defective are submitted for acceptance, what will be the average number of units inspected per lot under each of these sampling plans?
- Or
- (b) A single sampling plan is given as  $N=10000$ ,  $n= 100$  and  $c = 2$ . CO3 App (5)
- (i) Compare the approximate probability of acceptance of lots with 1% defective (use Poisson) (5)
  - (ii) Determine the AOQ value for the above lots (6)
  - (i) (iii) What will be the average inspection in percent? (Assume acceptance rectification plan)