

**LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034**

**M.Sc. DEGREE EXAMINATION – STATISTICS**

**FOURTH SEMESTER – APRIL 2010**

**ST 4810 / ST 4806 – STATISTICAL PROCESS CONTROL**

Date & Time: 17/04/2010 / 9:00 - 12:00 Dept. No.

Max. : 100 Marks

**SECTION – A**

**Answer ALL questions**

**( 10x2 =20 Marks)**

1. What are chance and assignable causes of variation?
2. Explain six-sigma quality.
3. How is lack of control of a process determined using control chart techniques?
4. Briefly explain the process –capability analysis.
5. Write down the control limits of a coefficient of variation chart.
6. What is an Average Run Length (ARL)?
7. Define rational sub group.
8. Describe the use of variable sampling method.
9. Write a short note on multivariate control chart.
10. Define a) Specification limits b) Natural tolerance limits.

**SECTION B**

**Answer any five questions**

**( 5 x 8= 40 Marks )**

11. Describe the various dimensions of quality.
12. Discuss the relationship between a control chart and statistical hypothesis testing.
13. In designing a fraction non-conforming chart with CL at  $p = 0.20$  and 3-sigma control limits, what is the sample size required to yield a positive LCL? What is the value of  $n$  necessary to give a probability of .50 of detecting a shift in the process to 0.26?
14. Write a detailed note on the moving average control chart

15. Estimate process capability using  $\bar{X}$  - bar chart and R chart for the power supply voltage data, if specifications are at  $350 \pm 5v$ , calculate  $c_p$ ,  $c_{pk}$  and  $e_{pkm}$ . Interpret these capability ratios.  
 $\bar{X}_i = (\text{observed voltage on unit } i - 350) / 10$

Sample no	1	2	3	4	5	6	7	8	9	10	11	12
$\bar{X}$ -bar	34.5	34.2	31.6	31.5	35.0	34.1	32.6	33.8	34.8	33.6	31.9	38.6
R	3	4	4	4	5	6	4	3	7	8	3	9
Sample no	13	14	15	16	17	18	19	20	21	22	23	24
x-bar	35.4	34.0	37.1	34.9	33.5	31.7	34.0	35.1	33.7	32.8	33.5	34.2
R	8	6	5	7	4	3	8	4	2	1	3	2

16. Write a detailed note on control charts based on extreme values.  
 17. A control chart for the fraction non – conforming is to be established using a centre line of  $p = 0.10$ . What sample size is required if we wish to detect a shift in the process fraction non – conforming to 0.20 with probability 0.50?  
 18. Outline the procedure of constructing a V-mask .

### SECTION C

**Answer any TWO questions**

**( 2 x 20= 40 Marks)**

- 19.(a) ). Distinguish between c and u charts. Explain the situations where c and u charts are applicable and how are the limits obtained for these charts.  
 b). What are acceptance and rejection lines of a sequential sampling plan for attributes?. How are the OC and ASN values obtained for this plan? (10+10)
- 20.a) What are modified control charts?. Explain the method of obtaining control limits for these charts.  
 b) A control chart for non-conformities per unit uses 0.95 and 0.05 probability limits .The center line is at  $u=14$ . Determine the control limits if the size of the sample is 10. (14+6)
- 21 a). What purpose does a cumulative sum chart serve?  
 b). Explain how will you use the tabular cusum for monitoring the process mean and variability. (5 + 15)
- 22 a) Explain with an illustration the method of obtaining the probability of acceptance for a double sampling plan.  
 b) What are continuous sampling plans and mention a few situations where these plans are applied. (12+8)

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