

## STATISTICAL QUALITY CONTROL AND COMPUTATIONAL TECHNIQUES - II

**Time Allowed : Three Hours**

**Maximum Marks : 100**

**Note :** Attempt one question each from Sections A, B, C and D carrying 20 marks each. Section E is compulsory consisting of 10 short answer type questions carrying 2 marks each.

### SECTION - A

- I. (a) Explain the meaning of (i) Quality, (ii) Quality assurance, and (iii) Process control.  
(b) Distinguish between Control charts for variables and Control charts for attributes. 10+10
- II. (a) Discuss the Importance of 3- $\sigma$  control limits in Statistical Quality Control.  
(b) Explain the criteria of detecting lack of control in  $\bar{X}$  and R charts. 10+10

### SECTION - B

- III. (a) Write the advantages of Double sampling plan over Single sampling plan.  
(b) Describe Double sampling plan. How will you calculate various probabilities like  $P_1, P_2, P_3, P_4$ ? 10+10
- IV. (a) An inspector with 80 percent efficiency uses the sampling plan  $n = 100, c = 1$ . Plot the effective O.C. curve.  
(b) Construct a single sampling plan for attributes, given the following data :  
A.Q.L. = 0.05, Producer's risk = 0.05, L.T.P.D. = 0.20, and Consumer's risk = 0.10. 10+10

### SECTION - C

- V. (a) Discuss in detail the problem of 'Numerical Differentiation' and 'Numerical Integration'.  
(b) Obtain Simpson's One-third rule of 'Numerical Integration'.  
Explain by comparing various methods of interpolation, which method of interpolation is better. 10+10
- VI. (a) Obtain Newton's Divided Difference formula. Also explain in which situation it is useful over other formulae of interpolation.  
(b) Obtain Lagrange's method of interpolation. Also write its advantages and disadvantages. 10+10

### SECTION - D

- VII. (a) Explain Simplex procedure to solve a linear programming problem.  
(b) Use Simplex method to solve the following LPP:  
Max.  $Z = 3x_1 + 2x_2$   
subject to  $x_1 + x_2 \leq 4$   
 $x_1 - x_2 \leq 2$   
 $x_1, x_2 \geq 0$ . 10+10
- VIII. (a) Let a primal LPP is to Maximize  $f(x) = Cx$ , s.t.  $Ax \leq b, x \geq 0, x^T, C \in R^n$  with its dual  
Min.  $g(w) = b^T w$ , s.t.  $A^T w \geq C^T, w \geq 0; w^T, b^T \in R^m$ . If  $X_0(w_0)$  is an optimum solution to the primal (dual) problem then there exists a feasible solution  $w_0(x_0)$  to the dual (primal) problem such that  $Cx_0 = b^T w_0$ .  
(b) Explain Transportation problem and show that it can be considered as an LPP. 10+10

### SECTION - E

#### (Compulsory Question)

- IX. Answer briefly all the following :
  - (a) Distinguish between Chance and Assignable causes.
  - (b) Explain the importance of using statistical methods in industrial research.
  - (c) Distinguish between 'Product control' and 'Process control'.
  - (d) Why sampling inspection plans are needed ?
  - (e) Explain the terms ASN and ATI.
  - (f) When Newton's Divided Difference formula is used ?
  - (g) Explain the uses of L.P.P.
  - (h) Explain the problem of lot acceptance.
  - (i) Explain Slack and Surplus variables.
  - (j) Write 3 $\sigma$  - control limit for u-charts.