Exam.Code:0006
Sub. Code: 0539

2054

B.A./B.Sc. (General) Sixth Semester

Statistics

Paper-303: Statistical Quality Control and Computational Techniques

Time allowed: 3 Hours **Max. Marks: 65**

NOTE: Attempt five questions in all, including Question No.1 which is compulsory and selecting two questions from each Unit. Use of simple non-programmable calculator is allowed. Statistical tables and log tables will be provided on request.

x-x-x

1. Provide concise answers to the following questions:
   (a) What do control limits do in industrial processes?
   (b) Define acceptance sampling and explain AQL and LTPD.
   (c) Distinguish between Newton's and Lagrange's interpolation methods.
   (d) What is the formulation of a Linear Programming Problem (LPP)? Provide a concise example.
   (e) What's the significance of duality in Linear Programming Problems (LPPs)?
   (3, 3, 3, 2, 2)

UNIT - I

2. (a) Explain the role of quality assurance in ensuring consistent product quality andcustomer satisfaction.

   (b) Describe the general theory of control charts and their applications in quality management. (6, 7)

3. (a)Identify common causes of variations in industrial processes that affect product quality.

   (b) Describe how mean and range charts are constructed and interpreted in monitoring process variability and maintaining process stability. (5, 8)

4. (a) Define control charts for attributes and explain their purpose in quality control.

   (b) Explain the process of constructing and interpreting a control chart for monitoring the proportion of defective units in a manufacturing process. (6, 7)

5. Explain the concept of acceptance sampling in quality control. Discuss the differences between single and double sampling plans, highlighting variations in ATI, ASN, and OC curves. (13)

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UNIT - II

6. (a) Explain the role of difference tables and divided differences in interpolation techniques, and discuss how they contribute to the accuracy of interpolation.

   (b) Using Simpson's 3/8 rule, approximate the value of the integral of the function $f(x) = e^{-x}$ from $x = 0$ to $x = 1$. Compare with exact integral also. (7, 6)

7. (a) Describe the numerical techniques for differentiation, including the Trapezoidal rule and Simpson's one-third formula, and discuss their applications in approximating definite integrals.

   (b) Using the Gauss-Seidel method, find the approximate solution of the following system of linear equations:

$$2x + 3y - z = 7$$
$$3x - y + 2z = 6$$
$$x + 2y + 3z = 10$$

   Start with initial guesses: $x_0 = 0, y_0 = 0, z_0 = 0$. Perform three iterations. (8, 5)

8. (a) Compare the graphical method and the simplex method for solving Linear Programming Problems (LPPs), highlighting their differences and advantages.

   (b) Solve the following linear programming problem by simplex method, after converting it into dual problem:

$$\text{Minimize } Z = 25x_1 + 10x_2$$

subject to

$$x_1 + x_2 = 50$$
$$x_1 \geq 20$$
$$x_2 \geq 40,$$
$$x_1, x_2 \geq 0.$$

(7, 6)

9. (a) What is a transportation problem? Write down the assumptions in the transportation model. Which is the best method to solve transportation problem?

   (b) Determine an initial basic feasible solution to the following transportation problem using (i) North-West corner method, (ii) Vogel's approximation method:

		Destination					supply
		W_1	W_2	W_3	W_4	W_5	
Origin	A	2	11	10	3	7	4
	B	1	4	7	2	1	8
	C	3	9	4	8	12	9
Demand		3	3	4	5	6	

(5, 8)