

U.G. 5th Semester Examination - 2020**STATISTICS****[PROGRAMME]****Discipline Specific Elective (DSE)****Course Code : STATG-DSE-T-1A**

Full Marks : 50(40+10)

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.***Answer all the questions from selected Option.****OPTION-A****STATG-DSE-T-1A****(Statistical Quality Control)**

1. Answer any **five** questions: 2×5=10
- What are control charts?
 - Distinguish between process control and product control.
 - Define ASN.
 - What is control chart for fraction defectives?
 - What are rational subgroups?
 - Distinguish between assignable and non-assignable causes of variation.

- Distinguish between tolerance limits and specification limits.
- What is average total inspection?

2. Answer any **two** questions: 5×2=10

- What do you mean by Type I and Type II errors in context of using control chart technique? Explain average run length (ARL) in context of using control chart technique.
- While preparing the control chart for process mean, how one can estimate the process standard deviation if it is unknown? State whether the estimate is valid when the underlying distribution is not normal.
- Discuss the concepts of Consumer's risk and AOQL.
- Explain LTPD plans with reference to a single sampling acceptance rectification plan by attribute.

3. Answer any **two** questions: 10×2=20

- i) The upper specification limit of the diameter of a fibre tube is given to the manufacturer. Explain how one can accept or reject a lot of such tube. Indicate any assumptions that you make.

- ii) For the plan in (i) obtain a suitable expression for the OC function when the process standard deviation is known. 4+6
- b) Describe single and double sampling inspection plans. Give a general outline of methods for determining the constants involved in single sampling plans.
- c) i) Discuss the advantages and disadvantages of sampling over 100% inspection.
- ii) Derive the control limits for fraction defectives when sample size varies. 5+5
- d) Discuss the probability limits and 3σ control limits in connection with the control charts. Give reasons of using 3σ limits in the construction of control charts.

[Internal Assessment: 10]

OPTION-B
STATG-DSE-T-1A
(Operations Research)

- 1. Answer any **five** questions: 2×5=10
 - a) Define convex set.
 - b) What is the importance of $z_j - c_j$ values in simplex algorithm?
 - c) Write down the optimality condition for a given transportation problem.
 - d) What is minimax-maximin principle?
 - e) What is a spanning tree?
 - f) Define value of a matrix game.
 - g) What is reorder point in an inventory model?
 - h) What is ABC analysis?
- 2. Answer any **two** from the following: 5×2=10
 - a) Describe a method of eliminating artificial variables in simplex algorithm.
 - b) Show that a transportation problem admits a feasible solution if and only if it is balanced.
 - c) A plant manager has four subordinates, and four tasks to be performed. The subordinates differ in efficiency and the tasks differ in their intrinsic difficulty. This estimate of the times each man would take to perform each task is given in the

effectiveness matrix below.

	1	2	3	4
A	19	26	24	10
B	38	19	18	15
C	13	28	4	26
D	8	26	17	11

How should the tasks be allocated, one to a man, so as to minimize the total man hours?

- d) Derive order quantity and ordering cycle length in a classic EOQ model without shortages.

3. Answer any **two** questions: $10 \times 2 = 20$

- a) i) Write down the fundamental theorem of linear programming.

- ii) Solve the problem:

$$\text{Maximize } z = 2x_1 + 4x_2 + 4x_3 - 3x_4$$

$$\text{subject to } x_1 + x_2 + x_3 = 4$$

$$x_1 + 4x_2 + x_4 = 8$$

$$x_1, x_2, x_3, x_4 \geq 0$$

2+8

- b) i) Define pure strategy and mixed strategy in the context of a matrix game.

- ii) Explain the concept of dominance with example in the context of a matrix game.

Write down the solution of a 2×2 game when there is no saddle point in the payoff matrix.

How can you solve a $2 \times n$ game? 3+7

- c) Solve the following transportation problem:

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Plants (Origin)	Distribution Centers (Destination)				
	1	2	3	4	a_i
A	1	2	1	4	20
B	3	3	2	1	40
C	4	2	5	9	20
D	5	3	6	10	20
b_j	20	40	30	10	100

- d) Write a note on duality in linear programming.

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[Internal Assessment: 10]
