No. of Printed Pages : 8 **MSTE–001**

POST GRADUATE DIPLOMA IN APPLIED STATISTICS (PGDAST)

Term-End Examination

December, 2025

MSTE-001 : INDUSTRIAL STATISTICS–I

Time : 3 Hours *Maximum Marks : 50*

Note : *(i) Question No. **1** is compulsory.*

*(ii) Attempt any **four** questions from the remaining Question Nos. **2** to **7**.*

(iii) Use of scientific (non-programmable) calculator is allowed.

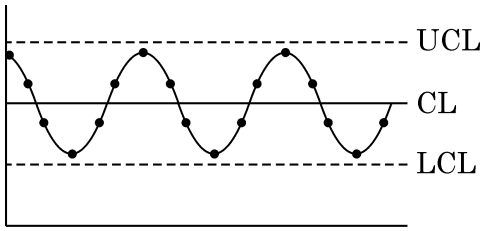
(iv) Use of Formulae and Statistical Tables Booklet for PGDAST is allowed.

(v) Symbols have their usual meanings.

1. State whether the following statements are True *or* False. Give reasons in support of your answers : 5×2=10

   (a) The OC curve for a sampling plan is a graph of the probability of rejecting a lot versus the proportion of defective units in the lot.

   (b) If the control chart of a process comes out as follows :



   then the process is in control.

   (c) If the maximin value = minimax value of the payoff matrix of a game, it has no saddle point.

   (d) Three independent components of a system are connected in series configuration. If the reliabilities of these components are 0.80, 0.75 and 0.95, respectively, then the reliability of the system will be 0.57.

(e) If the hazard rate of a component is constant λ, then the failure distribution of the component is binomial distribution.

2. (a) A quality controller of a football manufacturing company selects 20 random samples, each of 100 footballs drawn from time to time. After each football is inspected for defects, the following data are obtained :

Sample No.	Proportion of Defectives
1	0.19
2	0.16
3	0.30
4	0.18
5	0.17
6	0.19
7	0.18
8	0.19
9	0.33

10	0.15
11	0.16
12	0.27
13	0.18
14	0.25
15	0.18
16	0.17
17	0.27
18	0.16
19	0.17
20	0.18

Draw a suitable control chart and comment on the state of control. If required compute the revised control limits. 7

(b) What are the differences between control charts for variables and attributes ? 3.

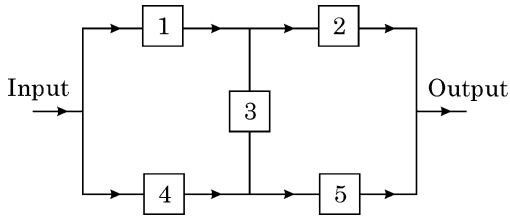
3. In a recently started process of producing bottles, their volume is subject to a quality control. The $\overline{X}$ and S values for 20 random

samples of size 5 each are given in the table. Construct the suitable control charts and state whether the process is under control or not. If not, compute the revised control limits : 10

Sample No.	$\overline{X}$	S
1	23	1.70
2	25	1.50
3	26	1.20
4	25	1.80
5	26	1.50
6	26	1.90
7	25	1.40
8	24	0.70
9	26	1.20
10	26	1.40
11	24	0.85
12	26	1.70
13	23	3.20
14	24	1.50

15	23	1.10
16	25	1.30
17	24	0.80
18	23	1.20
19	25	1.50
20	25	1.40

4. (a) Using cut set method, evaluate the reliability of the system having reliability block diagram given as follows for a mission of 1000 hours. It is given that components are independent and each component has reliability of 0.90 for a mission of 1000 hours. 8



(b) Define 'Payoff values' and 'States of Nature' in decision theory. 2

5. Solve the two-person zero-sum game having the following payoff matrix for Player A : 10

		Player B				
		B_1	B_2	B_3	B_4	B_5
Player A	A_1	2	3	3	1	6
	A_2	1	4	–5	7	5
	A_3	2	2	–1	4	8
	A_4	2	5	–2	3	3

6. (a) The failure density function of the random variable T is given by :

$$f(t) = 0.6 \exp(-0.6t); \quad t > 0$$

Calculate : 2+2+2+1

(i) Reliability of the system

(ii) Hazard rate

(iii) Mean time to failure

(iv) Cumulative failure distribution function

(b) Differentiate between the series and parallel systems with the help of diagrams. 3

7. (a) A manufacturer of remote car toys produces lots of 500 toy cars for shipment. A buyer uses a double sampling plan with n_1 = 10, c_1 = 1, n_2 = 20 and c_2 = 2 to test the quality of the lots. If the incoming lot quality is 0.05, what is the probability of (i) accepting the lot on the first sample, (ii) accepting the lot on the second sample, and (iii) final acceptance ? 2+3+1

   (b) Differentiate between the following with examples : 2+2

   (i) Acceptance and Rectifying sampling plans

   (ii) Producer's risk and Consumer's risk

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