

No. of Printed Pages : 8

MSTE-002

**POST GRADUATE DIPLOMA IN
APPLIED STATISTICS (PGDAST)**

Term-End Examination

June, 2026

MSTE-002 : INDUSTRIAL STATISTICS-II

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 calculator (non-programmable) is allowed.*

(iv) *Symbols have their usual meanings.*

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

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

- (a) For testing individual regression coefficients, the F-test is applied.
- (b) The region $\{(x, y) : 0 \leq y \leq 6 \text{ when } 0 \leq x \leq 3 \text{ and } 3 \leq x \leq 6 \text{ when } 3 \leq x \leq 7\}$ is not a convex set.
- (c) We obtain deseasonalised data by dividing original data by seasonal relatives.
- (d) An enterprise requires 1000 units per month. The ordering cost is estimated as ₹ 50 per order. In addition to ₹ 1, the carrying cost is 5% per unit of average inventory per year. If the purchase price is ₹ 20 per unit, then the economic lot size to be ordered will be 775.

- (e) In regression analysis, if $SS_{\text{Reg}} = 2.84$ and $SS_{\text{Res}} = 4.26$, then coefficient of determination is 0.4.
2. (a) A batch of 5 jobs can be assigned to five different machines. The time required (in hours) for each job on each machine is given in the following table :

Job \ Machine	Machine				
	M ₁	M ₂	M ₃	M ₄	M ₅
J ₁	8	3	11	13	4
J ₂	7	7	16	11	4
J ₃	8	5	2	2	2
J ₄	5	9	7	5	2
J ₅	5	8	5	8	4

Find an optimal assignment schedule of jobs to different machines which minimise the total set-up time. Also find the optimal total time. 7

- (b) Arrivals of the customers at a grocery shop are considered to follow Poisson distribution with an average arrival rate 6 per hour. The service time is assumed to be distributed exponentially with mean 3 minutes.

Find : 3

- (i) the probability that a person arriving at the shop will have to wait,
- (ii) the average number of customers at the shop.

3. Use the Simplex method to solve the following LP problem : 10

Maximize :

$$Z = 3x_1 + 5x_2 + 4x_3$$

subject to the constraints :

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

and $x_1, x_2, x_3 \geq 0$.

4. A specialist in hospital administration stated that the total number of full time employees (FTEs) in a hospital can be estimated by counting the number of beds in the hospital. A healthcare researcher decided to develop a regression model for that. She surveyed 12 hospitals and obtained the following data : 10

Number of Beds	FTEs
23	69
29	95
29	102
35	118
42	126
46	125
50	138
54	178
64	156
66	184
76	176
78	225

- (i) Develop the equation of regression to predict full time employees from the number of beds in a hospital.
- (ii) Calculate the residuals.
- (iii) Test the hypothesis that the regression coefficient (b) is significant at 5% level of significance. Assuming that :

$$\text{Var } (b) = \frac{\sigma^2}{SS_X} = 0.0625$$

5. The marketing manager of a company, that manufactures and distributes farming equipment recorded the number of farming units sold quarterly for the period 2020 to 2022 which are given in the following table :

	Summer	Monsoon	Winter	Spring
2020	48	41	60	65
2021	58	52	68	74
2022	60	56	75	78

Find the quarterly seasonal index for the farming equipments sold using ratio to trend method.

6. (a) Consider a time series model :

$$Y_t = 5 + 0.8y_{t-1} - 0.5y_{t-2} + \epsilon_t$$

where $\epsilon_t \sim N[0,2]$.

- (i) Is this a stationary time series ?
- (ii) Calculate auto-correlation function

ρ_1 and ρ_2 . 6

- (b) Differentiate between the following : 2+2

- (i) Simple and multiple regression
- (ii) Forward and backward selection method

7. (a) Determine all basic and feasible solutions of the following equations : 5

$$2x_1 + 3x_2 + 4x_3 = 5$$

$$3x_1 + 4x_2 + 5x_3 = 6$$

- (b) Use graphical method to minimise the time needed to process the following jobs on the 5 machines : 5

Job 1		Job 2	
Sequence	Time in hours	Sequence	Time in hours
A	3	B	5
B	4	C	4
C	2	A	3
D	6	D	2
E	2	E	6

× × × × ×