

7th Sem
CNPV 11.7.

Applied maths

1216106

A March 2 16

Con.1957-06.

(REVISED COURSE)
(3 Hours)

TV-8310
[Total Marks : 100

- N.B.** (1) Question No. 1 is compulsory.
 (2) Answer any four out of remaining six questions
 (3) **Figures** to the right indicate full marks.
 (4) Use of statistical tables is **permitted**.
 (5) Write the sub-questions of **main question** collectively together.

1. (a) Fit a parabola to the following data : 5
 x : -2 -1 0 1 2
 y : 1.0 1.8 1.3 2.5 6.3

- (b) A tyre company claims that the lives of the tyres have mean of 42000 kms. with S.D. of 4000 kms. A change in the production process is believed to result in a better product. A test sample of 81 new tyres has a mean life of 42500 kms. Test at 5% level of significance that the new product is significantly better than the current one. 5

- (c) Prove the properties of variance 5
 (i) $V(aX + b) = a^2 V(X)$
 (ii) $V(aX + bY) = a^2 V(X) + b^2 V(Y) + 2ab \text{ cov}(X, Y)$

- (d) A firm produces two products A and B which are processed on two machines. The relevant data is given below. 5

	Product A (min/unit)	Product B (min/unit)	Machine capacity (min/day)
Machine 1	2	3	18
Machine 2	1	3	12

The profit per unit products A,B is 6 and 10 Rs. respectively. Determine the daily No. of units to be manufactured of each product to get maximum profit. Formulate the L.P.P. and solve by using graphical method.

2. (a) An I.Q. test was administered to 5 persons and after they were trained. The results are given below. 6

	I	II	III	IV	V
I.Q. before training	110	120	123	132	125
I.Q. after training	120	118	125	136	121

Test whether there is any change in I.Q. after the training programme, use 1% level of significance.

- (b) Out of 800 families with 5 children each how many would you expect to have - 6
 (i) 3 boys and 2 girls (ii) 5 girls (iii) 5 boys ?

- (c) Use Kuhn Tucker condition to solve the following N.L.P.P. 8
 Maximize $Z = 8x_1 + 10x_2 - x_1^2 - x_2^2$
 Subject to $3x_1 + 2x_2 \leq 6$
 $x_1, x_2 \geq 0$

3. (a) State and prove Spearman's rank correlation coefficient. 6
 (b) A continuous random variable has p.d.f. 6

$$f(x) = 1 - x, \quad 0 < x < 1$$

$$= x - 1, \quad 1 < x < 2$$

$$= 0, \quad \text{otherwise}$$

Find mean and variance.

- (c) Using the Lagrangian Multipliers solve the following N.L.P.P. 8
 Optimize $Z = 2x_1^2 + 2x_2^2 + 2x_3^2 - 24x_1 - 8x_2 - 12x_3 + 196$
 Subject to $x_1 + x_2 + x_3 = 11$
 $x_1, x_2, x_3 \geq 0$

4. (a) Solve L.P.P. by Simplex method

Maximize $Z = 100x_1 + 50x_2 + 50x_3$

Subject to $4x_1 + 3x_2 + 2x_3 \leq 10$

$$3x_1 + 8x_2 + x_3 \leq 8$$

$$4x_1 + 2x_2 + x_3 \leq 6$$

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

- (b) Show that recurrence relation for the moments of Poisson distribution is –

$$\mu_{r+1} = r \mu_{r-1} + m \frac{d\mu_r}{dm}$$

- (c) A random sample of 220 students in a college were asked to give opinion in terms of yes or no about the winning of their college cricket team in a tournament. The following data are collected.

	Class in College		
	Ist year	IInd year	IIIrd year
Yes	43	20	37
No	23	57	40

Test whether there is any association between opinion and class in college (use 5% level of significance).

5. (a) If $u = x - y$, $v = x + y$ and if x, y are uncorrelated prove that,

$$r_{uv} = \frac{\sigma_x^2 - \sigma_y^2}{\sigma_x^2 + \sigma_y^2}$$

- (b) In a large institution 2.28% of employees receive income below Rs. 4500 and 15.87% of employees receive income above 7500 p.m. Assuming the income follows normal distribution. Find the mean and S.D. of the distribution.
- (c) Using Big-M method solve the L.P.P.

$$\begin{aligned} \text{Minimize } & Z = 10x_1 + 3x_2 \\ \text{Subject to } & x_1 + 2x_2 \geq 3 \\ & x_1 + 4x_2 \geq 4 \\ & x_1, x_2 \geq 0 \end{aligned}$$

6. (a) Find the dual of

$$\begin{aligned} \text{Minimize } & Z = 2x_1 + x_2 + 5x_3 \\ \text{Subject to } & x_1 + x_2 + x_3 = 10 \\ & 4x_1 - x_2 + 2x_3 \geq 12 \\ & 3x_1 + 2x_2 - 3x_3 \leq 6 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

Then write the 1st Iteration table by using Simplex method.

- (b) Solve the LPP by Big-M method.

$$\begin{aligned} \text{Minimize } & Z = 2x_1 + x_2 + 3x_3 \\ \text{Subject to } & 3x_1 + x_2 - 2x_3 \geq 1 \\ & x_1 - 2x_2 - x_3 \geq 2 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

- (c) Prove that mean and standard deviation of standard normal variate are zero and one respectively.

7. (a) Define Binomial distribution. Prove that mean = np and variance = npq .

- (b) The equation of the two lines of regression for a bivariate data are :

$$9x + 10y - 67 = 0 \text{ and } 5x + 2y - 23 = 0$$

- Find (i) mean values of x and y
(ii) regression coefficient
(iii) correlation coefficient.

- (c) Using the principle of duality solve the following L.P.P.

$$\begin{aligned} \text{Minimize } & Z = 4x_1 + 14x_2 + 3x_3 \\ \text{Subject to } & -x_1 + 3x_2 + x_3 \geq 3 \\ & 2x_1 + 2x_2 - x_3 \geq 2 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$