Paper / Subject Code: 40521 / Engineering Mathematics-IX
SEC (OMP) | SEM IV | FH-23 | R-19 | 09-05-28

Max. Marks: 80

N.B. (1) Question No. 1 is compulsory.

- &P WDE 27335
- (2) Answer any three questions from Q.2 to Q.5
- (3) Use of Statistical Tables permitted.
- (4) Figures to the right indicate full marks

Q1 a) If
$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$
 then find the Eigen values of $4A^{-1} + A^3 + I$

- b) Evaluate $\int_c |z| dz$, where C is the left half of unit circle |z| = 1 from z = -i to z = i.
- c) Maximise $z = x_1 + 3x_2 + 3x_3$ [5] Subject to $x_1 + 2x_2 + 3x_3 = 4$

$$2x_1 + 3x_2 + 5x_3 = 7.$$

Find all the basic solutions to the above problem. Which of them are basic feasible, non-degenerate, infeasible basic and optimal solution.

d) Tests made on breaking strength of 10 pieces of a metal wire gave the following results

Test if the breaking strength of the metal wire can be assumed to be 577 kg?

$$\int_C \frac{(z+4)^2}{z^4+5z^3+6z^2} dz, \text{ Where c is } |z|=1.$$

(b) Find
$$Z\{f(k) * g(k)\}\ if\ f(k) = 4^k U(k), g(k) = 5^k U(k).$$
 [6]

$$Maximise z = 3x_1 + 2x_2 + 5x_3$$

Subject to
$$x_1 + 2x_2 + x_3 \le 430$$

$$3x_1 + 2x_3 \le 460$$

$$x_1 + 4x_2 \leq 420$$

$$x_1, x_2, x_3 \ge 0$$

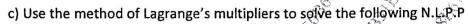
- Q3 a) Theory predicts that the proportion of beans in the four groups A, B, C, D should be
 - 9:3:3:1. In an experiment among 1600 beans the numbers in the four groups were 882, 313,

(Given that Critical value of chi-square 3 d. f and 5% L.O.S is 7.81)

b) Obtain Taylor's and Laurent's series expansion of
$$f(z) = \frac{z-1}{z^2-2z-3}$$
 [6]

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 $z = 6x_1 + 8x_2 - {x_1}^2 - {x_2}^2$ Optimize

 $4x_1 + 3x_2 = 16,$ Subject to

$$3x_1 + 5x_2 = 15$$

$$x_1, x_2 \ge 0$$

Q4a) fit a Poisson distribution to the following data

No. of deaths	0	. 4.	1	3	2	39	3	1	4	states. Since
Frequencies	123	,Q)	59	2	14	<i></i>	3	200	1	27

b) Find the inverse Z-transform of $\frac{1}{(z-2)(z-3)}$, if ROC is (i) |z| < 2 (ii) 2 < |z| < 3

c) Show that the matrix $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is diagonalizable. Find the transforming matrix and

the diagonal matrix.

Q5a) Using the method of Lagrange's multipliers to solve the following N.L.P.I

$$x_1, x_2 \ge 0. \tag{6}$$

b) Verify Cayley- Hamilton Theorem for the matrix A=[6]

c) Solve by the dual Simplex Method

[8]

Minimise $z = 6x_1 + x_2$

$$-x_2\geq 0, x_1,$$

Q6a) Find the Z-transform of
$$f(k) = \begin{cases} b^k, & k \le 0 \\ a^k, & k \ge 0 \end{cases}$$
 [6]

b) The income of a group of 10,000 persons were found to be normally distributed with mean Rs.520 and standard deviation Rs.60. Find the lowest income of the richest 500. [6]

c) Using Kuhn Tucker conditions, solve the following NLPP [8]

Maximise
$$z = 10x_1 + 4x_2 - 2x_1^2 + x_2^2$$

Subject to
$$2x_1 + x_2 \le 5 \le 0$$

$$x_1, x_2 \ge 0$$