SE SEM-IV NEP2020 May/2026
INFT
Date: 12/05/2026

Duration: 2 Hours **Marks: 60**

NB: (1) Question No. 1 is Compulsory.
(2) Attempt any three questions from remaining five.
(3) Figures to right indicate full marks.
(4) Assume Suitable data, if required and state it clearly.

Q1. Attempt any five questions

(a) *Find the Eigen value of AdjA where* $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ [3]

(b) *Find the residue of a function* $f(z) = \frac{z^2}{(z-2)(z+1)^2}$ *at its Simple pole* [3]

(c) *Find the z − transform of* $\left\{\left(\frac{1}{2}\right)^{|k|}\right\}$ [3]

(d) *Ten percent of Screws produced in a certain factory turn out to be defective. Find the Probability that in a sample of 10 screws chosen at random, exactly two will be defective.* [3]

(e) *Find the relative maximum or minimum of the function* [3]
$$z = x_1^2 + x_2^2 + x_3^2 - 4x_1 - 8x_2 - 12x_3 + 100$$

(f) *Maximise* $z = x_1 + 3x_2 + 3x_3$ [3]
Subject to: $x_1 + 2x_2 + 3x_3 = 4$
$2x_1 + 3x_2 + 5x_3 = 5$
Find all the basic solution. State which are not feasible

Q2. (a) *Find* $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ *by using Cayley − Hamilton theorem Where* $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ [4]

(b) *Evaluate* $\int_c \frac{\sin\pi z^2 + \cos\pi z^2}{(z-1)(z-2)} dz$ *where C is the circle* $|z| = 3$ [5]

(c) *In an intelligence test administered to 1000 students, the average was 42 and standard deviation was 24. Find the number of students (i) exceeding the score 50 and (ii) between 30 and 54* [6]

Q3. (a) *Find the Z − transform of* $\left\{Cos\left(\frac{k\pi}{8} + \alpha\right)\right\}$ [4]

(b) A random sample of 50 items give the mean 6.2 and standard deviation 10.24. Can it be regarded as drawn from a normal population with mean 5.4 at 5% L.O.S.? [5]

(c) *Show that the Matrix* $A = \begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ *is diagonalisable.* [6]
Find the transforming matrix and diagonal form

Q4. (a) *Find the inverse Z − transform of* $\frac{1}{(z-3)(z-2)}$ *for* $|z| > 3$ [4]

(b) *Using the method of Lagrange's multipliers, solve the following N.L.P.P.*

Optimise $z = 4x_1 + 8x_2 - x_1^2 - x_2^2$ [5]

Subject to : $x_1 + x_2 = 4$

$x_1; x_2 \geq 0$

(c) *Solve the L.P.P. by simplex method* [6]

Maximize $z = 6x_1 - 2x_2 + 3x_3$

Subject to: $2x_1 - x_2 + 2x_3 \leq 2$

$x_1 + 4x_3 \leq 4$

$x_1, x_2, x_3 \geq 0$

Q5. (a) *Evaluate* $\oint_c \frac{z+4}{z^2+2z+5} dz$ *where C is* $|z + 1 - i| = 2$ [4]

(*b*) *Solve the L.P.P. by dual simplex method* [5]

Minimize $z = 6x_1 + x_2$

Subject to: $2x_1 + x_2 \geq 3$

$x_1 - x_2 \geq 0$

$x_1, x_2 \geq 0$

(C) The means of two random samples of size 9 and 7are 196.42 and 198.82 respectively. The sum of the squares of the deviations from the means are 26.94 and 18.73 respectively. Can the samples be considered to have been drawn from the same population? [6]

Q6. (a) *Find the Z − transform of* $f(k) = \begin{cases} b^k & k < 0 \\ a^k & k \geq 0 \end{cases}$ [4]

(b) *Obtain taylor's and laurent's expansion of* $f(z) = \frac{z-1}{z^2-2z-3}$ [5]

for $1 < |z| < 3$

(c)*Using Kuhn − Tucker conditions, solve the following N.L.P.P.* [6]

Maximise $z = -x_1^2 - x_2^2 + 8x_1 + 10x_2$

Subject to : $3x_1 + 2x_2 \leq 6$

$x_1; x_2 \geq 0$

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