

Sem IV CMPN (KT) C-Scheme Winter 2025

(TIME: 03 HOURS)

(MAX. MARKS: 80)

17/12/2025

Note:

1. Question No. 1 is compulsory.
2. Attempt any three questions out of remaining five questions.
3. Assume suitable data wherever necessary.
4. Figures to right indicate full marks.

Q.1

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|----|--|-------|
| | | Marks |
| a. | Find the Eigen values of $A^3 - 3A^2 + A$ where $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$. | 05 |
| b. | Evaluate the integral $\int_0^{1+i} (x - y + i x^2) dz$ along (i) the parabola $y^2 = x$ (ii) The line $y = x$. | 05 |
| c. | Find the dual of the following L.P.P.
Max. $z = 2x_1 - x_2 + 3x_3$
Subject to $x_1 - 2x_2 + x_3 \geq 4$, $2x_1 + 0x_2 + x_3 \leq 10$,
$x_1 + x_2 + 3x_3 = 20$
$x_1, x_3 \geq 0$, x_2 unrestricted | 05 |
| d. | Find the z-transform of $f(k) = \left(\frac{1}{3}\right)^{ k }$. | 05 |

Q.2

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|----|--|-------|
| | | Marks |
| a. | Find the Eigenvalues and Eigenvectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$. | 06 |
| b. | The means of two random samples of size 9 and 7 are 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? | 06 |
| c. | Use the dual simplex method to solve the L.P.P.
Minimize $z = 2x_1 + x_2$
Subject to $3x_1 + x_2 \geq 3$;
$4x_1 + 3x_2 \geq 6$;
$x_1 + 2x_2 \leq 3$;
$x_1, x_2 \geq 0$ | 08 |

Q.3

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|----|--|-------|
| | | Marks |
| a. | Find the relative maximum or minimum of the function $Z = x_1 + 2x_3 + x_2x_3 - x_1^2 - x_2^2 - x_3^2$. | 06 |
| b. | Find the Z-transform of $\{2^k \sin(3k + 2)\}$, $k \geq 0$. | 06 |
| c. | Find all possible Laurent's expansion of $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ about $z = -1$. | 08 |

