SE. I.T. Sem-IV Dec-2025

SE | IV | C Scheme/ AIDS/ CSEIOT / IT / Comp / Dec-2025

(TIME: 03 HOURS) (MAX. MARKS: 80) 1/2

Dat 17/12/2025 Q.P. Code: 93321

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.

			Marks
Q.1	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 $f(k) = \left(\frac{1}{3}\right)^{\lvert k \rvert}$.	**05**
Q.2	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	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**

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Q.4 a. Verify Cayley-Hamilton theorem for the matrix A and hence find A^{-1} and A^4 **06**

where $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & -1 \end{bmatrix}$.

b. A die was thrown 132 times and the following frequencies were observed. **06**

No. obtained	1	2	3	4	5	6	Total
Frequency	15	20	25	15	29	28	132

Test the hypothesis that the die is unbiased.

c. Using the Kuhn –Tucker conditions to solve the N.L.P.P **08**

Maximize $z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

Subject to $2x_1 + 5x_2 \leq 98;$

$x_1, x_2 \geq 0.$

Q.5 a. Using Cauchy's residue theorem evaluate $\int_c \frac{e^z}{(z^2+\pi^2)^2} dz$ **06**

where C is the circle $|z| = 4$.

b. Using the method of Lagrange's multiplier solve the N.L.P.P **06**

Optimize $z = 12x_1 + 8x_2 + 6x_3 - x_1^2 - x_2^2 - x_3^2 - 23$

Subject to $x_1 + x_2 + x_3 = 10.$

$x_1, x_2, x_3 \geq 0.$

c. If the heights of 500 students is normally distributed with mean 68 inches and standard deviation 4 inches, estimate the number of students having heights (i) greater than 72 inches (ii) less than 62 inches (iii) between 65 and 71 inches. **08**

Q.6 a. Find the inverse z- transform of $F(z) = \frac{z}{(z-1)(z-2)}$, $|z| > 2$. **06**

b. Show that the matrix $A = \begin{bmatrix} 4 & 2 & -2 \\ -5 & 3 & 2 \\ -2 & 4 & 1 \end{bmatrix}$ is diagonalisable. Find the diagonal form D and diagonalizing matrix M. **06**

c. Solve the L.P.P by simplex method. **08**

Maximize $z = 3x_1 + 5x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 0x_3 \leq 8.$

$0x_1 + 2x_2 + 5x_3 \leq 10.$

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

$x_1, x_2, x_3 \geq 0.$

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