# Paper / Subject Code: 38911 / Engineering Mathematics-IV

### SE / SEM IV/COMP/AIDS/IT/C SCHEME/NOV 2023/ 08.12. 23

#### Time: 3 hrs

#### Marks: 80

#### Note:



- 2) Solve any three from Q. No. 02 to 06.
- 3) Numbers to the right indicate full marks.
- 4) Use of statistical tables is allowed.

### Q. 1. Solve.

a) If 
$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$
 find the sum and product of Eigen values  $A$ .

- b) Integrate the function  $f(z) = z^2$  from A(0, 0) to B(1, 1) along straight line AB.
- c) Find the Z-Transform of  $(k) = a^k$ , k < 0.
- A transmission channel has a per-digit error probability p = 0.01. Calculate the probability of more than 1 error in 10 received digits using Poisson distribution.

# Q. 2.

Find the Eigenvalues and Eigenvectors of the matrix 
$$A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$$
.

- b) Find the Z-Transform of  $Cos\left(\frac{k\pi}{4} + \alpha\right)$   $k \ge 0$ .
- c) Use the dual simplex method to solve the LPP Min..  $Z = 2X_1 + 2X_2 + 4X_3$ ,  $2X_1 + 3X_2 + 5X_3 \ge 2$ ,  $3X_1 + X_2 + 7X_3 \le 3$ ,  $X_1 + 4X_2 + 6X_3 \le 5$   $X_1, X_2, X_3 \ge 0$  8

### Q. 3.

a) Evaluate 
$$\int_C \frac{z^2}{(z-1)(z-2)} dz$$
 Where C is a circle  $|z-1|=1$ .

b) Verify Caley-Hamilton theorem and hence find  $A^{-1}$  and  $A^4$  where A =

Solve the LPP by Big -M method Maximize  $Z = 3X_1 - 2X_2$  subject to  $2X_1 + X_2 \le 2$ ,  $X_1 + 3 \ge 3$ ,  $X_1, X_2, \ge 0$ .

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Q. 4.

- a) Find inverse Z transform of  $F(z) = \frac{1}{(z-1)(z-3)}$  for i) |z| < 1, ii) |z| < 3.
- b) The following data represent the marks obtained by 12 students in two tests, one held before the coaching and the other after the coaching.

Test I : 55, 60, 65, 75, 49, 25, 18, 30, 35, 51, 61, 72. Test II : 63, 70, 70, 81, 54, 29, 21, 38, 32, 50, 70, 80. 6

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Do the data indicate that the coaching was effective in improving the performance of the students?

Find all possible Laurent's series expansions of the function  $f(z) = \frac{1}{(z-1)(z+2)}$  about z = 0 indicating the region of convergence in each case.

Q. 5.

a) Determine all basic solutions to the following problem

 $Max. Z = x_1 - 2x_2 + 4x_3$ 

 $x_1 + 2x_2 + 3x_3 = 7$ ,  $3x_1 + 4x_2 + 6x_3 = 15$ ,  $x_1, x_2, x_3 \ge 0$ .

- b) Using Normal distribution, find the probability of getting 55 heads in the toss of 100 fair coins.
- Solve the NLPP
  Optimize  $Z = 10x_1 + 8x_2 + 6x_3 + 2x_1^2 + x_2^2 + 3x_3^2 100$ Subject to  $x_1 + x_2 + x_3 = 20$ ,  $x_1, x_2, x_3 \ge 0$ .

Q. 6.

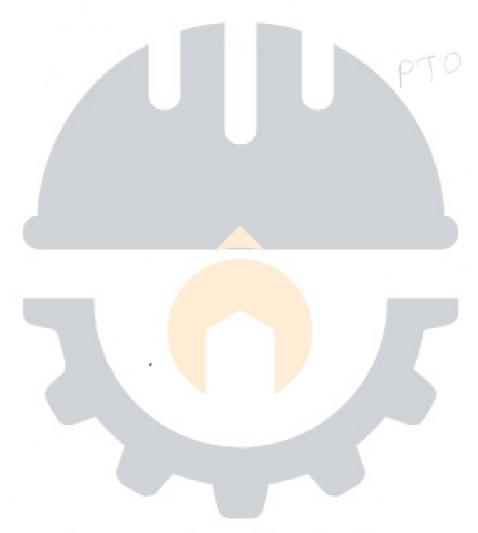
- Show that the given matrix is diagonalizable and hence find diagonal form and transforming matrix where  $A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$ .
- b) Of the 64 off springs of a certain cross between guinea pigs 34 were red, 10 were black and 20 were white. According to the generic model these numbers should be in the ratio 9:3:4. Use 2- test to check whether the data are consistent with the model.
- c) Max.  $Z = 4x_1 + 6x_2 {x_1}^2 {x_2}^2 {x_3}^2$ , Subject to  $x_1 + x_2 \le 2$  and  $2x_1 + 3x_2 \le 12$ ,  $x_1$ ,  $x_2 \ge 0$  by K-T condition.

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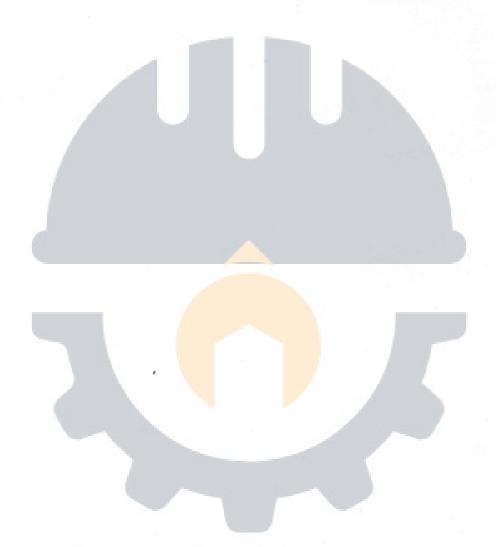
In SE Computer Q. P. Code 40268 there is a minor mistake in Q.6.B. in SE Computer Q. P. Code 40268. It is Use 2-test but its sprinting mistake it is Use  $\chi^2$  - test



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Correction in Q.P.Code: 10040268

Q.3.C. in SE Computer Q. P. Code 40268. In the second Condition  $X_2$  is missing so the correct condition is  $X_1 + 3X_2 \ge 3$ .



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