

[This question paper contains 4 printed pages.]

3047

Your Roll No. ....

MEC

J

Paper – CE.502

(Advanced Mathematics and Numerical Techniques)

Time : 3 hours

Maximum Marks : 100

(Write your Roll No. on the top immediately  
on receipt of this question paper.)

Attempt any **FIVE** questions.  
You can ask for statistical tables.

1. (a) Solve by Gauss-Seidal method, the equations :

$$54x + y + z = 110$$

$$2x + 15y + 6z = 72$$

$$-x + 6y + 27z = 85$$

Correct upto three decimal places.

- (b) Find the eigen values and eigen vectors of

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix} \quad (10,10)$$

2. (a) Using elementary transformations, find the inverse  
of

$$A = \begin{bmatrix} 7 & 8 & 2 \\ -1 & 2 & 4 \\ 3 & 6 & 8 \end{bmatrix}$$

P.T.O.

- (b) Discuss the consistency of the following system of equations

$$2x + 3y + 4z = 11$$

$$x + 5y + 7z = 15$$

$$3x + 11y + 13z = 25$$

If found consistent, solve it. (10+10)

3. (a) Show that an analytic function with constant real part is constant and an analytic function with constant modulus is also constant.

- (b) If  $f(z)$  is analytic function of  $z$ , prove that

$$\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |f(z)|^2 = 4 |f'(z)|^2 \quad (10+10)$$

4. (a) Find the bilinear transformation which maps the points  $Z_1 = 2$ ,  $Z_2 = i$  and  $Z_3 = -2$  into the points  $W_1 = 1$ ,  $W_2 = i$  and  $W_3 = -1$ .

- (b) State and prove Cauchy's integral formula and

evaluate  $\int_C \frac{3z-1}{z^3-1} dz$  where  $C$  is  $|z| = \frac{1}{2}$ .

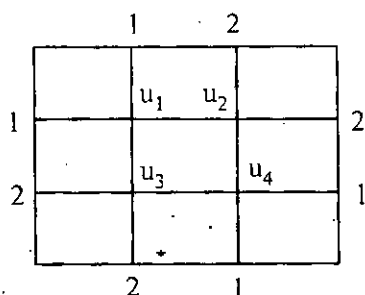
(10+10)

5. (a) Solve the boundary value problem

$$y'' = x + y \text{ with the boundary conditions}$$

$$y(0) = y(1) = 0 \text{ taking } n = 4.$$

- (b) Solve the equation  $\nabla^2 u = 0$  for the following square mesh in which the boundary values are prescribed. Iterate correct upto three decimal places.



(10+10)

6. (a) Find the coefficient of correlation between price and supply of a commodity from the following data.

Price (Rs.):	17	18	19	20	21	22	23	24	25	26
Supply (in kg):	38	37	38	33	32	33	34	29	26	23

- (b) Two random variables have the regression lines with equation  $3x + 2y = 26$  and  $6x + y = 31$ . Find the mean values and the correlation coefficient between  $x$  and  $y$ .

(10+10)

7. (a) Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results.

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	27	

Test whether you can discriminate between two horses.

- (b) A die is thrown 120 times and the frequencies of various faces are as follows :

Free No.	1	2	3	4	5	6
Frequency	10	15	25	25	18	27

Test whether the die was fair. (10+10)