

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)  
B. Tech. Sem - I MECHANICAL : WINTER- 2022  
SUBJECT : LINEAR ALGEBRA, CALCULUS & COMPLEX VARIABLES

Day : Monday

Time : 10:00 AM-01:00 PM

Date : 9/1/2023

W-24057-2022

Max. Marks : 60

N.B.:

- 1) All questions are COMPULSORY.
- 2) Figures to the right indicate FULL marks.
- 3) Use of non programmable CALCULATOR is allowed.
- 4) Assume suitable data if necessary.

Q.1 Find the Eigen values and Eigen vectors for the following matrix. (10)

$$A = \begin{bmatrix} 2 & -3 & 1 \\ 3 & 1 & 3 \\ -5 & 2 & -4 \end{bmatrix}$$

OR

Find the Eigen values and Eigen vectors for the following matrix. (10)

$$A = \begin{bmatrix} 2 & -1 & 1 \\ 1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$$

Q.2 Find  $\frac{du}{dx}$  given that  $u = x \log xy$  and  $x^2 + y^2 = -3xy$ . (10)

OR

If  $\phi(x, y, z) = 0$  then find  $\left(\frac{dz}{dy}\right)_x$ ,  $\left(\frac{dx}{dz}\right)_y$ ,  $\left(\frac{dy}{dx}\right)_z$ . (10)

Q.3 Find  $\nabla(e^{-r^3})$  where  $r = \sqrt{x^2 + y^2 + z^2}$ . (10)

OR

Find  $\text{curl curl } \vec{F}$  at  $(0, 1, 2)$  where  $\vec{F} = x^2 y \hat{i} + xyz \hat{j} + z^2 y \hat{k}$ . (10)

P.T.O.

- Q.4 Verify stoke's theorem for  $\vec{F} = xy^2\hat{i} + y\hat{j} + z^2x\hat{k}$  for the surface of rectangular lamina bounded by  $x=0, y=0, x=1, y=2, z=0$  (10)

OR

- Verify Green's theorem for the field  $\vec{F} = x^2\hat{i} + xy\hat{j}$  over the region R enclosed by  $y = x^2$  and line  $y = x$ . (10)

- Q.5 If  $v = 3x^2y - y^3$  find its harmonic conjugate  $u$ . Also, find  $f(z) = u + iv$  in terms of  $z$ . (10)

OR

- If  $u = \frac{1}{2} \log(x^2 + y^2)$ , find  $v$  such that  $f(z) = u + iv$  is analytic. Determine  $f(z)$  in terms of  $z$ . (10)

- Q.6 Find the residues at each of the poles of  $f(z) = \frac{z^3 + 2}{(z+1)^2(z-i)(z+2)}$ . (10)

OR

- Evaluate  $\int_C \frac{2z^2 + 2z + 1}{(z+1)^3(z-3)} dz$  (10)

Where  $C$  is the contour  $|z+1|=2$

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