Roll No. | | | | | | | | | | | | | **Total No. of Pages : 03**

Total No. of Questions : 09

B.Tech. (Agriculture Engineering) (Sem.–1)

ENGINEERING MATHEMATICS-I

Subject Code : BTAG-101-22

M.Code : 92759

Date of Examination : 13-01-23

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION - B & C. have FOUR questions each.**
3. **Attempt any FIVE questions from SECTION B & C carrying EIGHT marks each.**
4. **Select atleast TWO questions from SECTION - B & C.**

SECTION-A

l. Write short notes on :

a) Evaluate the triple integral $\int_0^2 \int_0^2 \int_0^{yz} xyzdxdydz$.

b) State stoke's theorem in the plane.

c) Evaluate $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dydx$.

d) Show that the vector field given by $\vec{F} = (-x^2 + yz)\hat{i} + (4y - z^2x)\hat{j} + (2xz - 4z)\hat{k}$ is solenoidal.

e) State homogeneous function.

f) Find the gradient of the function $\varphi = y^2 - 4xy$ at (1, 2).

g) Prove that curl(grad ϕ) = 0

h) If $f(x, y) = x^2y + xy^3 - 3x + 4y - 6$, find $\frac{\partial f}{\partial x}$.

i) Define Eigen values.

j) Explain nature of rank of a Matrice.

SECTION-B

2. Use Gauss Jordan Method to find the inverse of a matrix $\begin{bmatrix} 2 & 4 & 3 & 2 \\ 3 & 6 & 5 & 2 \\ 2 & 5 & 2 & -3 \\ 4 & 5 & 14 & 14 \end{bmatrix}$.

3. If $U = \text{cosec}^{-1}\left(\frac{x^{\frac{1}{2}} + y^{\frac{1}{2}}}{x^{\frac{1}{3}} + y^{\frac{1}{3}}}\right)^{\frac{1}{2}}$, prove that

$$x^2\frac{\partial^2 U}{\partial y^2} + 2xy\frac{\partial^2 U}{\partial x \partial y} + y^2\frac{\partial^2 U}{\partial y^2} = \frac{13 + \tan^2 U}{144}$$

4. Prove that :

a) curl $(\phi \vec{A}) = (grad\phi) \times \vec{A} + \phi\, curl\, \vec{A}$.

b) Evaluate $\int_c (x^2 + xy)dx = (x^2 + y^2)dy$, where c is the square formed by the lines $x = \pm 1, y = \pm 1$.

5. Evaluate $\int_0^1 \int_{x^2}^{2-x} xydydx$ by changing order of integration.

SECTION-C

6. Show that the Matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is similar to the diagonal Matrix. Also find the transforming Matrix and the diagonal Matrix.

7. If $\theta = t^n e^{\frac{-r^2}{4t}}$, find the value of n which will make $\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial\theta}{\partial r}\right) = \frac{\partial\theta}{\partial t}$.

8. Verify Gauss Divergence theorem for $\vec{F} = (x+y^2)\,\hat{i} - 2x\,\hat{j} + 2yz\,\hat{k}$ taken over tetrahedron bounded by coordinate planes and the plane $2x + y + 2z = 6$.

9. Calculate volume of the solid bounded by the planes

$$x = 0, y = 0, z = 0, x + y + z = 1.$$

NOTE : Disclosure of Identity by writing Mobile No. or Marking of passing request on any paper of Answer Sheet will lead to UMC against the Student.