

Roll No.

Total No. of Pages :02

Total No. of Questions :18

B.Tech. (Bio Technology/Civil Engineering/Computer Science & Engineering/Electrical & Electronics Engineering/Electrical Engineering/Electronics & Communication Engineering/Information Technology/Mechanical Engineering)(Sem.-1)

ENGINEERING MATHEMATICS-I

Subject Code :BTAM-101

M.Code :54091

Date of Examination : 01-07-22

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

Solve the following:

1. Find the percentage error in the area of an ellipse when an error of +1 percent is made in measuring the major and minor axes.
2. If $x = r \cos \theta$ and $y = r \sin \theta$, Verify that $\frac{\partial(x, y)}{\partial(r, \theta)} \times \frac{\partial(r, \theta)}{\partial(x, y)} = 1$.
3. Find the radius of the curvature of $y^2 = 4ax$ at any point (x, y) .
4. State Greens theorem in the plane.
5. Find the equation of tangent plane for the surface $xyz = 6$ at $(1, 2, 3)$.
6. Evaluate $\int_0^{\infty} \int_x^{\infty} \frac{e^{-y}}{y} dy dx$.
7. State Stoke's theorem.
8. Find the gradient of the function $\phi = y^2 - 4xy$ at $(1, 2)$.
9. 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.
10. Define homogenous function.

SECTION-B

11. Use Lagrange's method to find the minimum value of $x^2 + y^2 + z^2$ subject to the conditions $x + y + z = 1$ and $xyz + 1 = 0$.
12. If $U = \tan^{-1} \frac{x^3 + y^3}{x - y}$.
- Prove that $x^2 \frac{\partial^2 U}{\partial x^2} + 2xy \frac{\partial^2 U}{\partial x \partial y} + y^2 \frac{\partial^2 U}{\partial y^2} = \sin 4u - \sin 2u = 2 \cos 3u$.
13. a) Find all the asymptotes of the curve
 $y^3 - 3x^2y + xy^2 - 3x^3 + 2y^2 + 2xy + 4x + 5y + 6 = 0$.
- b) Find the moment of inertia of the area between $y = \sin x$ from $x = 0$ to $x = n$ and x -axis about each axis.
14. Trace the curve $y^2 = \frac{x^3}{2a - x}$.

SECTION-C

15. a) Find the volume common to the cylinders $x^2 + y^2 = a^2$ and $x^2 + z^2 = a^2$.
- b) Evaluate $\iiint x^2 y z dx dy dz$ over the region bounded by $x = 0, y = 0, z = 0, x + y + z = 1$.
16. 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 $2x + y + 2z = 6$.
17. Prove that:
- a) $\text{curl}(\phi \vec{A}) = (\text{grad } \phi) \times \vec{A} + \phi \text{curl } \vec{A}$
- b) $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$.
18. Verify Stoke's theorem for $\vec{F} = (x^2 + y - 4)\hat{i} + 3xy\hat{j} + (2xz + z^2)\hat{k}$ over the surface of hemisphere $x^2 + y^2 + z^2 = 16$ above XOY plane.

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