Roll No. ☐☐☐☐☐☐☐☐☐

Total No. of Questions: 09　　　　　　　　　　　Total No. of Pages: 02

B.Tech　(Sem. – 1)
ENGINEERING MATHEMATICS-I
Subject Code: BTAM-101
M Code: 54091
Date of Examination : 16-01-23

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, carrying EIGHT marks each.**
3. **Attempt any FIVE questions from SECTION B & C, selecting atleast TWO questions from each of these SECTIONS B & C.**

SECTION-A

1. Answer the following:

   a) If u is a homogenous function of degree n in x, y then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = nu$

   b) Evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}dxdy$

   c) Find length of curve $y = \log \sec x$ between $x = 0$ to $x = \frac{\pi}{3}$

   d) If error committed in measuring sides of square is 2%.Find an error in calculating the area.

   e) Define curvature.

   f) Find the directional derivative of $x^2y - y^2z - xyz$ at point $(1,-1,0)$ in direction of $\hat{i} - \hat{} + 2\hat{k}$

   g) Prove div (curl v) = 0 where v is differentiable vector field.

   h) State Stoke's theorem.

   i) Find the work done by the force F in moving a particle from a point P to the point Q $F = x^2\hat{i} + y\hat{z} + z\hat{k}$, C is the line from (1,2,2) to (3,4,2).

   j) Find $\frac{dy}{dx}$ when $x^y + y^x = \alpha$, where α is any constant

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SECTION-B

2. If $z = f(x,y)$, $x = r\cos\theta$, $y = r\sin\theta$, then show that $\left(\frac{\partial f}{\partial x}\right)^2 + \left(\frac{\partial f}{\partial y}\right)^2 = \left(\frac{\partial f}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial f}{\partial \theta}\right)^2$

3. Find extreme values of $f(x,y) = x^3 y^2 (1 - x - y)$

4. Find area outside the circle $r = 2a\cos\theta$ & inside the cardioid $r = a(1 + \cos\theta)$

5. If ρ_1 and ρ_2 be radii of curvature at extremities of two conjugate diameter of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ then prove that $\left(\rho_1^{2/3} + \rho_2^{2/3}\right)(ab)^{2/3} = a^2 + b^2$

SECTION-C

6. Evaluate the surface integral $\iint F.ndA$ over the surface S, where S is the portion of the surface of cylinder $x^2 + y^2 = 36, 0 \leq z \leq 4$ included in the first octant and $F = z^2\hat{\imath} + xy\hat{\jmath} - y^2\hat{k}$

7. Give physical interpretation of curl.

8. Find volume of ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$

9. Verify divergence theorm if $v = 3x^2\hat{\imath} + 6y\hat{\jmath} + z\hat{k}$ and D is the region bounded by closed cylinder $x^2 + y^2 = 16, z = 0$ and $z = 4$.

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.