Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 18

**B.Tech. (2012 to 2017) (Sem.–1)**

# ENGINEERING MATHEMATICS-I

**Subject Code : BTAM-101**

**M.Code : 54091**

**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. Define point of inflexion.

2. Find total derivative of $z = tan^{-1}\left(\frac{x}{y}\right)$.

3. Using differentials, find appropriate value of $\sqrt{(298)^2 + (401)^2}$.

4. Find volume of unit sphere using triple integral.

5. Find the directional derivative of $f(x, y, z) = xy^2 + 4xyz + z^2$ at point (1, 2, 3) in direction of $3\hat{i} + 4\hat{j} - 5\hat{k}$

6. Prove curl (grad f) = 0, where $f$ is differentiable scalar field.

7. State Gauss divergence theorem.

8. Find the work done by the force F = $-xy\hat{i} + y^2\hat{j} + z\hat{k}$ in moving a particle over the circular path $x^2 + y^2 = 4, z = 0$ from (2, 0, 0) to (0, 2, 0).

9. Evaluate $\iint (x^2 + y^2)\, dxdy$ over the unit circle.

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

## SECTION-B

11. If $u = \sin^{-1}\left(\dfrac{x^3 + y^3 + z^3}{ax + by + cz}\right)$, then prove that $xu_x + yu_y + zu_z = 2 \tan u$.

12. A rectangular box open at top is to have volume of 32 cubic feet. Find dimensions of box requiring least material for its construction.

13. a) Find length of four cusped hypocycloid $x = a \cos^3 \theta, y = b \sin^3\theta$.

    b) Find volume generated by revolution of cardiod $r = a (1 - \cos \theta)$ about $x$ axis.

14. Find the curvature at point $\left(\dfrac{3a}{2}, \dfrac{3a}{2}\right)$ of curve $x^3 + y^3 = 3\,axy$.

## SECTION-C

15. Evaluate the surface integral $\iint F.n\ dA$ where $F = 6z\hat{i} + 6\hat{j} + 3y\hat{k}$ and S is the portion of the plane $2x + 3y + 4z = 12$, which is in the first octant?

16. Give physical interpretation of divergence.

17. Verify Stoke's theorem for vector field V = $(3x - y)\hat{i} - 2yz^2\hat{j} - 2y^2z\hat{k}$ where S is surface of sphere $x^2 + y^2 + z^2 = 16, z > 0$.

18. Evaluate $\iiint \dfrac{dxdydz}{\sqrt{1 - x^2 - y^2 - z^2}}$, over the region $x^2 + y^2 + z^2 = 1$.

**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.**