Roll No.

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

B. Tech. (Sem. 1)

ENGINEERING MATHEMATICS-I

Subject Code: BTAM-101

Paper ID: A1101

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

INSTRUCTIONS TO CANDIDATES:

1. **Attempt all sub-questions from Question 1 (2 Marks each)**
2. **Attempt any FIVE questions from Sections A and B, selecting at least 2 from each Section (8 Marks each)**

SECTION A

l. (a) Trace the curve $x^2 = y^3$.

(b) Find the area bounded by, $y^2 = 9x$ and $y = -x$.

(c) Find the length of an arc of the parabola, $y = x^2$ measured from the vertex.

(d) If $u = x^y$,then find $\frac{\partial^3 u}{\partial x \partial y \partial x}$.

(e) Mention any one advantage and any one disadvantage of Lagrange's method of multipliers.

(f) Evaluate $\int_0^1 \int_0^{\sqrt{y}} xy\, dx\, dy$.

(g) If $\overrightarrow{F\ (t)}$ has a constant direction, then show that $\vec{F} \times \frac{d\vec{F}}{dt} = \vec{0}$.

(h) Find grad φ where $\varphi = 3x^2 y - y^3 z^2$ at the point (1, -2, -1).

(i) If $= \vec{F}= 3xy\,\vec{\imath} - y^2\,\vec{\jmath}$, evaluate $\int \vec{F} \times d\vec{r}$ along the curve $y = 2x^2$ from (0, 0) to (1, 2).

(j) State Stoke's theorem.

SECTION B

2. Trace the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$, giving proper arguments.

3. Find the volume of the solid generated by revolving an arc of the catenary, $y = c \cosh \frac{x}{c}$ about x-axis between x = a and x = b.

4. If $u = sin^{-1} \frac{x^2+y^2}{x+y}$, find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$

5. Examine the extreme values of $x^3 + y^3 - 3axy$.

SECTION C

6. Evaluate after changing the order of integration,

$$\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx.$$

7. If $\vec{V}$ and $\vec{U}$ be the vectors joining the fixed points (x_1, y_1, z_1) and (x_2, y_2, z_2) respectively to a variable point (x,y,z) then show that,

grad $(\vec{V}.\vec{U}) = \vec{V} + \vec{U}$.

8. Verify Green's theorem in the plane for $\int (3x^2 - 8y^2)dx + (4y - 6xy)dy$ along the boundary of the region enclosed by $x = 0, y = 0, \ x + y = 1$.

9. If $\vec{E}$ and $\vec{H}$ are irrotational, prove that $\vec{E} \times \vec{H}$ is solenoidal.