Roll No. Total No. of Pages: 03

**Total No. of Questions: 09** 

B.Tech. (Sem.-1st)

### **ENGINEERING MATHEMATICS-I**

Subject Code : BTAM-101 (2011 & 2012 Batch)

Paper ID: [A1101]

Time: 3 Hrs. Max. Marks: 60

#### **INSTRUCTION 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

1. a) Find asymptotes, parallel to axes, of the curve:

$$x^2 y^2 - xy^2 - x^2y + x + y + 1 = 0.$$

- b) Write a formula to find the volume of the solid generated by the revolution, about y-axis, of the area bounded by the curve x = f(y), the y-axis and the abscissae y = a and y = b.
- c) What is the value of  $\frac{\partial(u,v)}{\partial(x,y)} \times \frac{\partial(x,y)}{\partial(u,v)}$ ?
- d) If an error of 1% is made in measuring the length and breadth of a rectangle, what is the percentage error in its area?
- e) Find the equation of the tangent plane to the surface

$$z^2 = 4(1 + x^2 + y^2)$$
 at  $(2, 2, 6)$ .

f) What is the value of  $\int_{0}^{1} \int_{x^{2}}^{2-x} xy dx dy$ 

- g) Give geometrical interpretation of  $\int_{0}^{1} \int_{0}^{1-x} dx dy$ .
- h) Show that the vector field  $\vec{F} = (x^2 y^2 + x)\hat{i} (2xy + y)\hat{j}$  is irrotational.
- i) What is the value of  $\nabla \times (xy\hat{i} + yz\hat{j} + zx\hat{k})$ ?
- j) State Stoke's theorem.

## SECTION-B

2. Trace the following curves by giving their salient feature:

a) 
$$x^3 + y^3 = 3axy$$
.

b) 
$$r = a(1 + \cos\theta) \tag{4,4}$$

- 3. a) Find the perimeter of the cardioid  $r = a (1-\cos \theta)$ .
  - b) Find the area bounded by two parabolas  $y^2 = 4x$  and  $x^2 = 4y$ . (4,4)

4. a) If 
$$u = \frac{y}{z} + \frac{z}{x}$$
, show that  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z} = 0$ 

b) State Euler's theorem for homogeneous functions and apply it to show that

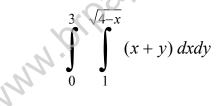
$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3 \tan u$$

where 
$$\sin u = \frac{x^2 y^2}{x+y}$$
 (4,4)

- 5. a) Find points on the surface  $z^2 = xy + 1$  nearest to the origin.
  - b) Find percentage error in the area of an ellipse if one percent error is made in measuring its major and minor axes. (4,4)

### **SECTION**

6. a) Evaluate the following integral by changing the order of integration:



- b) Find the volume of the ellipsoid  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ . (4,4)
- 7. a) Find a unit vector normal to the surface  $x^3 + y^3 + 3xyz = 3$  at the point (1, 2, -1).
  - b) If  $\overrightarrow{F} = (x + y + 1) \hat{i} + \hat{j} (x + y) \hat{k}$ , show that  $\overrightarrow{F}$  curl  $\overrightarrow{F} = 0$ . (4,4)
- 8. a) Compute the line integral  $\int (y^2 dx x^2 dy)$ , where C is the boundary of the triangle whose vertices are (1,0), (0,1) and (-1, 0).
  - b) Compute  $\int_{S} \vec{F} \cdot \vec{N} ds$ , where  $\vec{F} = 6z\hat{i} 4\hat{j} + y\hat{k}$  and S is the portion

(4,4)

State Gauss Divergence theorem and verify it for

of the plane 2x + 3y + 6z = 12 in the first octant.

 $\overrightarrow{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$  taken over the rectangular parallelopiped  $0 \le x \le a$ ,  $0 \le y \le b$ ,  $0 \le z \le c$ . (8) WWW.Dibsi