

Roll No. ....

Total Pages : 3

BT-1/D-18

31001

MATHEMATICS-I

Paper : Math-101 (E)

Opt. (I)

Time : Three Hours]

[Maximum Marks : 100

Note : Attempt five questions in all. Select at least one question from each unit. All questions carry equal marks.

UNIT-I

1. (a) Using Maclaurin's series, expand the function as

log (1 + sin x) = x - x^2/2 + x^3/6 - x^4/12 + ..... 10

(b) Find the asymptotes of the curve

4x^3 + 2x^2 - 3xy^2 - y^3 - 1 - xy - y^2 = 0. 10

2. (a) Find the radius of curvature at the origin of the curve

y - x = x^2 + 2xy + y^2. 10

(b) Trace the curve r = a(1 - cos theta). 10

UNIT-II

3. (a) If z = tan (y + ax) - (y - ax)^3/2, show that

d^2z/dx^2 = a^2 d^2z/dy^2. 10

(b) If u = sin^-1((x+y)/(sqrt(x)+sqrt(y))), prove that

x du/dx + y du/dy = 1/2 tan u, and

x^2 d^2u/dx^2 + 2xy d^2u/dx dy + y^2 d^2u/dy^2 = -sin u . cos 2u / (4 cos^3 u). 10

4. (a) If u = x^2 - 2y^2, v = 2x^2 - y^2, where x = r cos theta,

y = r sin theta, show that d(u,v)/d(r,theta) = 6r^3 sin 2theta. 10

(b) Find the maximum distance from the origin to the curve

5x^2 + 6xy + 5y^2 - 8 = 0. 10

UNIT-III

5. (a) Evaluate integral from 0 to 1 of integral from 0 to sqrt(1+x^2) of dy dx / (1+x^2+y^2). 10

(b) Evaluate by changing order of integration

integral from 0 to 1 of integral from 0 to sqrt(1-y^2) of x^3 y dx dy. 10

6. (a) Solve  $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz \, dx \, dy \, dz.$  10
- (b) Find the volume bounded by the  $xy$ -plane, the cylinder  $x^2 + y^2 = 1$  and the plane  $x + y + z = 3.$  10

#### UNIT-IV

7. (a) Calculate the angle between the normals to the surface  $xy = z^2$  at the points  $(4, 1, 2)$  and  $(3, 3, -3).$  10
- (b) Find the directional derivative of the function  $f(x, y, z) = xy^2 + yz^3$  at the point  $(2, -1, 1)$  in the direction of vector  $\hat{i} + 2\hat{j} + 2\hat{k}.$  10
8. (a) Evaluate  $\int_C \mathbf{F} \cdot d\mathbf{R},$  where  $\mathbf{F} = [2z, x, -y]$  and  $C$  is  $\mathbf{R} = [\cos t, \sin t, 2t]$  from  $(1, 0, 0)$  to  $(1, 0, 4\pi).$  10
- (b) Find the area of a circle of radius ' $a$ ' using Green's theorem. 10

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