647510 **BSCmaMJ204x-2C** **Seat No :_________**

B.Sc. Semester - 2 (NEP-2020) Examination
MARCH/APRIL-2025
MATH: Partial Derivatives & Differential Geometry (Major-4)

Time: 2:00 Hours **Marks: 50**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate marks.

Que-1(A) Answer any one question out of two. (05)

(1) if function Z = f(x,y) possesses the first order partial derivatives in the Domain D and x=g(t), y=h(t) also possesses its first order partial derivatives then show That $\frac{dz}{dt} = \frac{\partial z}{\partial x}\frac{dx}{dt} + \frac{\partial z}{\partial y}\frac{dy}{dt}$.

(2) if u = f(z) and $z^2 = x^2 + y^2$ then prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f''(z) + \frac{1}{z}f'(z)$.

Que-1(B) Answer any one question out of two. (05)

(1) State young's theorem and obtain $\frac{\partial z}{\partial x}$ *and* $\frac{\partial z}{\partial y}$ from f(x,y,z)= 0 by without giving Simplification.

(2) If $y^3 - 3ax^2 + x^3 = 0$ then find $\frac{d^2y}{dx^2}$.

Oue-2(A) Answer any one question out of two. (05)

(1) If $f(x,y) = x^3 + xy + y^3$ then find the approximate value of f(1.01,2.98).

(2) Expand log(xy) in power of (x-1) and (y-1).

Que-2(B) Answer any one question out of two. (05)

(1) Find the greatest and smallest value of the function f(x,y)=xy takes on ellips $\frac{x^2}{8} + \frac{y^2}{2} = 1$.

(2) Find the shortest distance from origin to the surface $xyz^2 = 2$.

Que-3(A) Answer any one question out of two. (05)

(1) In usual notations, derive radius of curvature for Cartesian curves.

(2) Find radius of curvature at any point on the cardiod $r = a(1+\cos\theta)$.

Que-3(B) Answer any one question out of two. (05)

(1) Define radius of curvature and find radius of curvature at origin for the Curve $x^2+2xy+2y^2-4x = 0$.

(2) In usual notation derive radius of curvature for polar curves.

Que-4(A) Answer any one question out of two. (05)

(1) Obtain the oblique asymptotes of the general algebraic curve.

(2) Define concavity and convexity of the curve and also prove that $y = e^x$ is Concave upward everywhere.

Que-4(B) Answer any one question out of two. (05)

(1) Find the position and nature of double points of the curve $x^4-2ay^3-3a^2y^2-2a^2x^2+a^4 = 0$.

(2) Find all asymptotes to the curve $y^3-6xy^2+11x^2y-6x^3+x+y = 0$.

Que-5(A) Answer any one question out of two. (05)

(1) Define: Rectangular nbhd, circular nbhd, Limit of a function of two variables, Continuity of a function of two variables, Homogeneous function.

(2) if u= x+y+z , uv= y+z , uvw= z then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$ *and* $\frac{\partial(u,v,w)}{\partial(x,y,z)}$.

Que-5(B) Answer any one question out of two. (05)

(1) Find radius of curvature at origin for the curve $x = a(\theta + \sin\theta)$, $y = a(1-\cos\theta)$.

(2) Show that origin is a point of inflexion for the curve $y = x^3$

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