

B.Sc. Semester - 5 (Remedial) (NEP-2020) Examination

March/April-2026

MATH: Fundamentals of Partial Differential Calculus
(For Chemistry & Physics Students) (Minor-5)

Time: 2:00 Hours

Marks:50

Instructions:

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

Que.1 Attempt any TWO out of THREE.

(10)

(1) Find $f_x(0,0)$ and $f_y(0,0)$ by definition $f(x, y) = \begin{cases} \frac{x(x^2-y^2)}{x^2+y^2}; & (x, y) \neq (0,0) \\ 0; & (x, y) = (0,0) \end{cases}$

(2) If $u = \log(x^2 + y^2) + \tan^{-1}(\frac{y}{x})$ then find $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$.

(3) State and prove Euler's theorem for homogeneous function of two variables.

Que.2 Attempt any TWO out of THREE

(10)

(1) Expand $e^x \sin y$ in power of x and y .

(2) Find minima of $f(x, y) = x^2 + 2y^2 - x$.

(3) Find the maximum value of $f(x, y, z) = xyz$ subject to the constraint $2x + 2y + z = 108$.

Que.3 Attempt any TWO out of THREE

(10)

(1) Derive the auxillary equation of partial differential equation $Pp + Qq = R$ using Lagrange's method.

(2) Find the partial differential equation using elimination of constant or functions of $z = f(x^2 - y^2)$.

(3) Using Charpit's method solve, $q = 3p^2$.

Que.4 Attempt any TWO out of THREE

(10)

(1) Classify the given second order P.D.E. and solve it $\frac{\partial^2 z}{\partial x^2} + 2 \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = e^{2x+3y}$.

(2) If $f(D, D')$ is a homogeneous function of D and D' of degree n and $f(x, y)$ is of form $\phi(ax + by)$ then show that

$$\frac{1}{f(D, D')} \phi(ax + by) = \frac{1}{f(a, b)} \int \int \cdots \int \phi(v) (dv)^n.$$

(3) Using Monge's method solve $y^2 r - 2ys + t = p + 6y$.

Que.5 Attempt any TWO out of THREE

(10)

(1) If $f(x, y) = x^2 y - 3y$ then find approximate value of $f(5.2, 6.85)$

(2) If $u = \sin^{-1}(x^2 + y^2)^{1/5}$ then find $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.

(3) Solve: $r + 6s + 9t = 0$.
