

B.Sc. Semester - 4 (NEP-2020) Examination
March/April-2026 (As Per Syllabus Year June-2025)
MATH: Advanced Calculus -2 (Major-9)

Time: 2:00 Hours

Marks: 50

Instructions:

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

Que.1 Answer any two out of the following. (10)

1. Derive the Lagrange's Auxiliary equation.
2. Find the partial differential equation of $z = f(x^2 - y^2)$, using elimination of constants or functions.
3. Solve the equation $q = 3p^2$ using Charpit's method.

Que.2 Answer any two out of the following. (10)

1. Classify the given second ordered differential equation 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 the form $\phi(ax + by)$ then show that,

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

3. Solve $y^2 r - 2ys + t = p + 6y$ by using Monge's method.

Que.3 Answer any two out of the following. (10)

1. State and prove: First shifting theorem.
2. Find Laplace transform of $f(t) = e^{-3t} \cosh 4t \sin 3t$.
3. Show that Laplace transform is linear.

Que.4 Answer any two out of the following. (10)

1. Find Laplace transform of $f(t) = t \left(\frac{\sin t}{e^t} \right)^2$.
2. Find inverse Laplace transform of $F(s) = \frac{s+4}{s(s-1)(s^2+4)}$.
3. Find Laplace transform of $e^{-t} \int_0^t \frac{\sin t}{t} dt$.

Que.5 Answer any two out of the following. (10)

1. State and prove: Convolution theorem.
2. State and prove: Monge's theorem.
3. Show that: (1) $L[te^{at} \cos bt] = \frac{(s-a)^2 - b^2}{((s-a)^2 + b^2)^2}$.

$$(2) L[te^{at} \sin bt] = -\frac{2b(s-a)}{((s-a)^2 + b^2)^2}$$
