

B.Sc. Semester - 2 (NEP-2020) Examination

MARCH/APRIL-2026 (As Per Syllabus Year June-2023)

MATH: Theory of Ordinary Differential Equations (Major-3)

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 (05)
- (1) State and prove the necessary and sufficient conditions for a differential equation to be exact.
 - (2) Solve: $x^2 \frac{dy}{dx} = 3x^2 - 2xy + 1$.
- Que.1(B) Answer any one (05)
- (1) Solve: $x \frac{dy}{dx} - y = y^2 \log x$.
 - (2) Solve: $(x^2 + y^2)dx - 2xydy = 0$.
- Que.2(A) Answer any one (05)
- (1) State general form of Clairaut's differential equation and find it's solution.
 - (2) Solve: $y = 2px - \frac{1}{3}p^2$
- Que.2(B) Answer any one (05)
- (1) Solve: $p^3 + 2xp^2 - y^2p^2 - 2xy^2p = 0$.
 - (2) Solve: $y = 3p + 4p^2$.
- Que.3(A) Answer any one (05)
- (1) Prove that if $f(-a^2) \neq 0$, then $\frac{1}{f(D^2)} \sin ax = \frac{1}{f(-a^2)} \sin ax$.
 - (2) Prove: $\frac{1}{f(D)} e^{ax} V = e^{ax} \frac{1}{f(D+a)} V$; where V is a function of x .
- Que.3(B) Answer any one (05)
- (1) Solve: $\frac{d^3y}{dx^3} - 12 \frac{d^2y}{dx^2} + 6 \frac{dy}{dx} - 8y = e^{2x}$.
 - (2) Solve: $(D^2 - 7D + 12)y = e^{5x}$.
- Que.4(A) Answer any one (05)
- (1) Solve: $x^2 \frac{d^2y}{dx^2} - 2x \frac{dy}{dx} + 2y = 4x^3$.
 - (2) Solve: $(x^2 D^2 - 2xD - 4)y = x^4$.
- Que.4(B) Answer any one (05)
- (1) Solve: $(x^2 D^2 + 7xD + 5)y = x^5$
 - (2) Solve: $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} - 6x \frac{dy}{dx} + 6y = \left(x^2 - \frac{1}{x^2}\right)^2$
- Que.5(A) Answer any one (05)
- (1) Solve: $\frac{dy}{dx} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0$.
 - (2) Solve: $e^{4x}(p - 1) + e^{2y}p^2 = 0$.
- Que.5(B) Answer any one (05)
- (1) Solve: $\frac{d^2y}{dx^2} + 4y = \sin 2x$
 - (2) Solve: $x^3 \frac{d^3y}{dx^3} - x^2 \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} - 2y = 0$.
