

North Gauhati College  
Department of Mathematics

SEMESTER III(GENERIC & REGULAR)  
HOME ASSIGNMENT 2022

**MAT-HG-3016/MAT-RC-3016**  
**Differential Equations**

January 2022

TOTAL MARKS: 30

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INSTRUCTIONS TO CANDIDATES

1. This assignment paper contains **Three (3)** questions and comprises **Three (3)** printed pages.
2. Answer all questions. The marks for each question are indicated at the beginning of each question.
3. Submit the assignment as a single **PDF** file through the online portal of our college website under section “Assignments” and submit a hard copy in the Department of Mathematics.
4. Write your **Name**, **GU Roll No.**, and **Registration Number** in the assignment .
5. Submission **Due Date** is on or before **22nd January, 2022**.

**Question 1.**

[1+4+5=10]

- (i) Write down the general form of a first-order linear ordinary differential equation.
- (ii) Solve the initial-value problem that consists of the differential equation

$$(x^2 + 1) \frac{dy}{dx} + 4xy = x$$

and the initial condition  $y(2) = 1$ .

- (iii) Find the solution of the Bernoulli differential equation

$$\frac{dy}{dx} + y = xy^3.$$

**Question 2.**

[5+5=10]

- (i) Find the orthogonal trajectories of the family of parabolas  $y = cx^2$ .
- (ii) Find a family of oblique trajectories that intersect the family of straight lines  $y = cx$  at an angle  $45^\circ$ .

**Question 3.**

[2+3+1+4=10]

- (i) Write down the general form of a linear differential equation of  $n$ th order.
- (ii) Consider the differential equation

$$\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2y = 0.$$

- (a) Show that  $e^x$ ,  $e^{-x}$  and  $e^{2x}$  are linearly independent solutions of this equation on the interval  $-\infty < x < \infty$ .

- (b) Write the general solution of the given equation.
- (iii) Given that  $y = x$  is a solution of

$$(x^2 + 1)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$$

find a linearly independent solution by reducing the order.

**END OF PAPER**