North Gauhati College
Department of Mathematics

SEMESTER II(HONOURS)
HOME ASSIGNMENT

MAT-HC-2026
Differential Equations

October 2021 TOTAL MARKS: 30

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 send a copy to the email id **mathngc1969@gmail.com**.
4. Write your **Name**, **GU Roll No.**, and **Registration Number** in the assignment .
5. Submission **Due Date** is on or before 8th October, 2021.

Question 1. [1+2+3+4=10]

(i) When is a differential equation said to be exact?

(ii) Is the equation

$$(x^2 + 2xy^2)dx + (2x^2y + y^2)dy = 0$$

exact? Solve it.

(iii) Show that $e^{\int P dx}$ is the integrating factor of the linear differential equation

$$\frac{dy}{dx} + Py = Q,$$

where $P,\ Q$ are functions of x alone or constants.

Question 2. [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 3. [2+3+1+4=10]

(i) Write down the general form of a linear differential equation of nth 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