

North Gauhati College
Department of Mathematics

SEMESTER III(GENERIC & REGULAR)
ASSIGNMENT I

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

August 2021

TOTAL MARKS: 40

INSTRUCTIONS TO CANDIDATES

1. This assignment paper contains **FOUR (4)** 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 **7th August, 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 $e^{\int Pdx}$ 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.

[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° .

Question 4.

[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