

# The Assam Royal Global University, Guwahati

Royal School of Applied and Pure Sciences

B.Sc. Mathematics, 2<sup>nd</sup> semester

Semester End Examination, August 2021

Course Title: Ordinary Differential Equation

Course Code: MAT012C203

Time: 3 Hours

Maximum Marks: 70

Note: Attempt all questions as per instructions given.

The figures in the right-hand margin indicate marks.

## Section – A

1. Attempt **all** questions. (Maximum word limit 50) 2 x 8
- Write the standard form of Clairaut's equation. What is the general solution of  $y = px + p - p^2$ ?
  - Form the differential equation from the relation  $y = e^x (a \cos x + b \sin x)$ , where  $a$  and  $b$  are arbitrary constants.
  - Test whether  $y_1 = \sin x$ ,  $y_2 = \cos x$  are linearly independent or not.
  - Find the complementary function of  $\frac{d^2 y}{dx^2} + 4y = \cos 2x$ .
  - Verify the condition of integrability for  $z dx + z dy + 2(x + y + \sin z) dz = 0$ .
  - Solve  $\frac{dx}{z} = \frac{dy}{0} = \frac{dz}{-x}$
  - What is trajectory?
  - Write some applications of ODE.
2. Attempt **any two** of the following: 6 x 2
- Solve the differential equation  $\frac{dy}{dx} + \frac{x}{1-x^2} y = x\sqrt{y}$ .
  - Solve  $4xp^2 - 8yp - x = 0$
  - Check whether  $(x^2 y^2 + xy + 1)y dx + (x^2 y^2 - xy + 1)x dy = 0$  is exact or not. Hence solve it.
3. Attempt **any two** of the following: 7 x 2
- Solve by the method of undetermined coefficients  $\frac{d^2 y}{dx^2} - 2\frac{dy}{dx} + 5y = 25x^2 + 2$ .
  - Solve by operator method  $xy'' + (x-2)y' - 2y = x^3$ .
  - (i) Solve  $(D^2 - 5D + 6)y = e^x \cos 2x$ .  
(ii) Prove that  $\cos 2x$  and  $\sin 2x$  are solutions of the differential equation  $y'' + 4y = 0$  and these solutions are linearly independent.

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**Section – B**

**4. Attempt any two of the following: 7 x 2**

a. Solve the simultaneous equations  $\frac{dx}{dt} + 5x - 2y = t$ ,  $\frac{dy}{dt} + 2x + y = 0$ .

b. Solve

(i)  $\frac{dx}{z(x+y)} = \frac{dy}{z(x-y)} = \frac{dz}{x^2+y^2}$

(ii)  $\frac{dx}{xz(z^2+xy)} = \frac{dy}{-yz(z^2+xy)} = \frac{dz}{x^4}$

c. Show that the condition of integrability is satisfied for  $(yz + z^2)dx - xzdy + xydz = 0$ .

Hence solve it.

**5. Attempt any two of the following: 7 x 2**

a. A particle starting with velocity  $u$  moves in a straight line with a uniform acceleration  $f$ . Find the velocity and distance travelled in any time.

b. Find the orthogonal trajectories of the rectangular hyperbola  $xy = c^2$ .

c. Find the orthogonal trajectories of the family of curves  $f(x,y,c)=0$ ,  $c$  being the variable parameter.