

(i) Printed Pages : 3

Roll No. ....

(ii) Questions : 8

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Exam. Code : 

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B.A./B.Sc. (General) 3<sup>rd</sup> Semester

1125

## MATHEMATICS

### Paper : II : Differential Equations-I

Time Allowed : Three Hours]

[Maximum Marks : 30

**Note** :- Paper is divided into **two** Units : Unit-I and Unit-II. Each Unit contains **four** questions. Students are required to attempt **five** questions selecting at least **two** questions from each Unit.

#### UNIT-I

1. (a) Find the necessary and sufficient condition that the equation  $Mdx + Ndy = 0$  may be exact where M and N are functions of x and y with the condition that M, N,  $\frac{\partial M}{\partial y}$ ,  $\frac{\partial N}{\partial x}$  are continuous functions of x, y.
- (b) Solve and test for singular solution :

$$p^3 - 4pxy + 8y^2 = 0 \text{ where } p = \frac{dy}{dx}. \quad 3+3=6$$

2. (a) Solve the differential equation :

$$y'' + y = x e^x \sin 2x.$$

- (b) Solve  $(p - 1) e^{4x} + p^2 e^{2y} = 0$  where  $p = \frac{dy}{dx}$ .  $3+3=6$

3. (a) Solve the differential equation :

$$\frac{d^2y}{dx^2} + a^2y = \sec ax.$$

- (b) Show that the system of confocal conics  $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$  is self orthogonal. 3+3=6

4. (a) Solve  $(3x^2y^4 + 2xy)dx + (2x^3y^3 - x^2)dy = 0$ .

- (b) Find the orthogonal trajectory of  $r^n = a^n \cos n\theta$ . 3+3=6

## UNIT-II

5. (a) Solve  $(x^2D^2 + 3xD + 1)y = (1 - x)^{-2}$  where  $D = \frac{d}{dx}$ .

- (b) Solve  $\sqrt{x} \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} + 3y = x, x > 0$ . 3+3=6

6. (a) Solve  $(D^2 - 1)y = 2(1 - e^{-2x})^{-1/2}$  by method of variation of parameters.

- (b) Find the particular solution of the Linear system

$$\frac{dx}{dt} = -2x + 7y$$

$$\frac{dy}{dt} = 3x + 2y \quad \text{where } x(0) = 1 \text{ and } y(0) = -1.$$

3+3=6



7. (a) Using operator method, find the general solution of the linear system  $\frac{dx}{dt} + \frac{dy}{dt} - x - 6y = e^{3t}$ ,  $\frac{dx}{dt} + 2\frac{dy}{dt} - 2x - 6y = t$ .

(b) Solve  $(3x + 2)^2 \frac{d^2y}{dx^2} + 5(3x + 2) \frac{dy}{dx} - 3y = x^2 + x + 1$ .  
3+3=6

8. (a) Solve  $\frac{d^2y}{dx^2} - \cot x \frac{dy}{dx} - (1 - \cot x)y = e^x \sin x$ .

(b) Solve  $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x^2 e^x$ .  
3+3=6