

Roll No. ....

**E-3920**

**B. C. A. (Part III) EXAMINATION, 2021**

**(Old Course)**

Paper Second

DIFFERENTIAL EQUATION AND FOURIER SERIES

**(301)**

*Time : Three Hours ]*

*[ Maximum Marks : 50*

**Note :** All questions are compulsory. Attempt any *two* Parts from each question. All questions carry equal marks. Only simple calculator is allowed, not scientific calculator.

**Unit—I**

1. (a) Solve :

$$\frac{dy}{dx} + \frac{y}{x} = y^2 \sin x.$$

(b) Solve :

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

(c) Solve :

$$y = 2px - xp^2.$$

**P. T. O.**

**Unit—II**

2. (a) Find orthogonal trajectories of the family of curves :

$$r^n = a^n \cos n\theta .$$

- (b) Solve :

$$\frac{d^2y}{dx^2} - 4y = e^x + \sin 2x .$$

- (c) Solve :

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - 4y = x^2 .$$

**Unit—III**

3. (a) Solve :

$$xzp + yzq = xy .$$

- (b) Solve by Charpit's method :

$$px + qy = pq .$$

- (c) Solve :

$$\frac{\partial^2 z}{\partial x^2} - a^2 \frac{\partial^2 z}{\partial y^2} = x^2 .$$

**Unit—IV**

4. (a) Find the Fourier series of the periodic function  $f(x)$ , where :

$$f(x) = \begin{cases} -\pi, & \text{when } -\pi < x < 0 \\ x, & \text{when } 0 < x < \pi \end{cases} ,$$

Hence deduce that :

$$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots .$$

**[ 3 ]**

(b) Find the Fourier series for the function :

$$f(x) = x, \quad -\pi < x < \pi.$$

(c) Find the Fourier series for the function  $f(x)$  where :

$$f(x) = x - x^2, \quad -1 < x < 1.$$

**Unit—V**

5. (a) Discuss Gibbs phenomenon with example.  
(b) Write application of Fourier series.  
(c) Write operations on Fourier series.