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F - 3970

B.C.A. (Part - III) Examination, 2022

(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: $\left(x^2 - yx^2\right)dy + (y^2 + xy^2)\,dx = 0$

(b) Solve: $\left(px - y\right)(x - yp) = 2p$

(c) Solve:

$$\left(x^2 + y^2 + 2x\right)\,dx + 2y\,dy = 0$$

Unit - II

2. (a) Find the orthogonal trajectories of the family of curves $y = a\,x^2$

(b) Solve: $\left(D^2 - 4\right)y = x^2$

(c) Solve: $\left(x^3 - x\right)\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} + n^2x^3y = 0$

Unit - III

3. (a) Obtain the partial differential equation by eliminating the arbitrary constant f:

$$z = f\left(x^2 - y^2\right)$$

(b) Solve: $x^2p + y^2\,q = z^2$

(c) Solve the partial differential equation by Charpit's method : $\left(p^2 + q^2\right)y = qz$

Unit - IV

4. (a) Find the Fourier Series of the function

$$f(x)=x^2,-\pi<x<\pi$$

Hence, deduce that

$$\frac{\pi^2}{12}=1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+.........$$

(b) If a function f is bounded and integrable on the interval $[-\pi, \pi]$ and if a_n, b_n are its fourier coefficients, then prove that the series $\sum_{n=1}^{\infty}\left(a_n^2+b_n^2\right)$ converges.

(c) Find the Fourier Series for the function, $f(x)$, given by

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

$$f(x+2\pi)=f(x)$$

Unit - V

5. (a) With the reference of Gibb's phenomenon describe functional approximation of square wave using 5 harmonies.

(b) Find the Fourier Series solution to the differential equation

$$y''+2y=3x$$

with the boundary conditions

$$y(0)=y(1)=0$$

(c) Explain pointwise convergence with reference to Fourier Series.