Roll No. .... **Total No. of Sections : 3**

Total No. of Printed Pages : 4

Annual Online Examination 2021

Code No. : A.B.C-392

B.C.A. Part III

MATHEMATICS

BCA-301

Paper II

[Differential Equation and Fourier Series]

Time : Three Hours] [Maximum Marks : 50

Note : *Section 'A' containing 10 very short answer type questions, is compulsory. Section 'B' consists of short answer type questions and Section 'C' consists of long answer type questions. Section 'A' has to be solved first.*

Section 'A'

Answer the following Very Short Answer Type Questions in one or two sentences. **1×10=10**

1. Find the order and degree of

$$\left(\frac{d^3y}{dx^3}\right)^2 - xy\left(\frac{dy}{dx}\right)^3 + y = 0.$$

2. Give an example of homogeneous differential equation.

3. Define trajectories.

4. Write differential operator of the nth order.

5. Give an example of partial differential equation of second order.

6. Define particular integral (P.I.).

7. Define piecewise monotonic functions.

8. Write Fourier cosine series.

9. Write one dimensional wave equation.

10. Write two dimensional cartesian form of Laplace equation.

Section 'B'

Solve the following questions. **3×5=15**

1. Solve : $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$.

Or

Solve : $p^2 + 2py \cot x - y^2 = 0$.

2. Solve : $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$.

Or

Find P.I. of $\frac{d^2y}{dx^2} - 4y = \sin 2x$.

3. Find the partial differential equation by eliminating the arbitrary function of $z = f(x + ay)$.

Or

Solve : $r - 3as + 2a^2 t = 0.$

4. Obtain Fourier sine series of $f(x) = e^{ax}$, $0 < x \leq \pi$.

Or

Explain periodic functions.

5. Classify the partial differential equation

$$(1 + x^2)\, u_{xx} + (5 + 2x^2)\, u_{xy} + (4 + x^2)\, u_{yy} = 0.$$

Section 'C'

Solve the following questions. **5×5=25**

1. Solve : $x^2 y dx - (x^3 + y^3)\, dy = 0.$

Or

Solve : $x = y + p^2.$

2. Solve : $\frac{dy}{dx} = \frac{2x + 9y - 20}{6x + 2y - 10}.$

Or

Solve : $xdx + ydy + \frac{xdy - ydx}{x^2 + y^2} = 0.$

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3. Solve : $(x - y)\, p + (x + y)\, q = 2xz.$

Or

Solve : $(D^2 + 2DD' + D' - 1)\, z = \sin(x + 2y).$

4. Find the Fourier series of the function $f(x) = x^2$ in $-\pi < x < \pi$. Hence deduce that $\frac{\pi^2}{12} = 1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + \ldots$

Or

Obtain the Fourier series for the function $f(x) = x^2$, $-\pi < x < \pi$ and $f(x + 2\pi)$. Hence deduce that $\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}.$

5. Solve two dimensional Laplace equation which depends only r.

Or

Solve the following boundary value problem $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial t^2} = xt,\ u(x, 0) = 0,\ u_t\,(x, 0) = 0.$

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