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Annual Examination, 2020

B.C.A. Part III

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 the degree of the equation

$$\frac{d^2y}{dx^2}+\sqrt{1+\left(\frac{dy}{dx}\right)^3}=0.$$

2. Define exact differential equation.

3. Define linear differential equation

4. Give an example of homogeneous linear equation.

5. Find the order of the equation $r^2 = at$.

6. Define the complementary function (C.F.).

7. Define periodic functions.

8. Define half range Fourier Series.

9. Write one application of Fourier Series.

10. Write Laplace's equation in two dimensions.

Section 'B'

Answer the following short answer type questions with word limit 150–200. **3×5=15**

1. Solve : $\dfrac{dy}{dx} = \dfrac{x}{y}$.

Or

Solve : $xyp^2 + (3x^2 - 2y^2)p - 6xy = 0$.

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

Or

Examine the differential equation for exactness :

$$3x^2dx - 2ydy = 0.$$

Or

Obtain Fourier's series of the function $f(x) = x \sin x$ in the interval $(-\pi, \pi)$.

5. Prove that $u = \dfrac{a}{r} + b$ is a solution of $\Delta^2 u = 0$ in the form of r where $r = \sqrt{x^2 + y^2 + z^2}$ and a and b are constants.

Or

Transform two dimensional Laplace's equation in cylindrical form.

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1. Solve : $x(x-y)\frac{dy}{dx} = y(x+y)$.

Or

Solve : $y^2 \log y = xyp + p^2$.

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

Or

Solve : $(1 + e^{x/y})\,dx + e^{x/y}\left(1 - \frac{x}{y}\right)dy = 0$.

3. Solve : $(y+z)p + (z+x)\,q = x + y$.

Or

Solve : $(r + s - 6t) = y \cos x$.

4. Find a series of sines and cosines of multiples of x which will represent the function $f(x) = x + x^2$ in the interval $-\pi < x < \pi$. Hence show that :

$$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \ldots.$$

3. Obtain the partial differential equation by eliminating the arbitrary functions f :

$$z = f\left(\frac{y}{x}\right).$$

Or

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

4. Obtain a_n of the Fourier Series for $f(x) = e^{-x}$ in the interval $0 < x < 2\pi$.

Or

Define Fourier Cosine Series.

5. Classify the partial differential equation :

$$\frac{\partial^2 u}{\partial x^2} + 2\frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0.$$

Or

Discuss method of separation of variables for a boundary value problem.

Section 'C'

Answer the following long answer type questions with word limit 300–350. **5×5=25**