



বিদ্যাসাগর বিশ্ববিদ্যালয়
VIDYASAGAR UNIVERSITY
Question Paper

B.Sc. General Examinations 2021

(Under CBCS Pattern)

Semester - II

Subject : MATHEMATICS

Paper : DSC 1B/2B/3B-T

Differential Equations

Full Marks : 60

Time : 3 Hours

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer any **four** of the following questions :

4 × 15 = 60

1. (a) Obtain the differential equation of all circles each of which touches the axis of x at the origin. 5
- (b) Solve : $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$ 5
- (c) Solve : $\frac{dy}{dx} = \frac{x+y+1}{x+y-1}$ 5
2. (a) Reduce the equation $\frac{dy}{dx} + \frac{1}{x}y = x^2y^6$ to a linear equation and hence solve it. 5

- (b) Solve any one : 5
- (i) $\frac{dy}{dx} + \frac{1-2x}{x^2} y = 1$
- (ii) $x \cos x \frac{dy}{dx} + (x \sin x + \cos x) y = 1$
- (c) Solve and find the singular solution of the differential equation : 5
- $(px - y)(x - py) = 2p$ where $p = \frac{dy}{dx}$.
3. (a) Solve by the method of variation of parameters $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} = 1, x > 0$, it being given that $y = x^{-1}, y = 1, y = x$ are three linearly independent solutions of its reduced equation. 5
- (b) Solve : $x^3 \frac{dy}{dx} = y^3 + y^2 \sqrt{(y^2 - x^2)}$ 5
- (c) Find an integrating factor of the equation $(x^4 y^2 - y) dx + (x^2 y^4 - x) dy = 0$ and hence solve it. 5
4. (a) Reduce $x^2 p^2 + y(2x + y)p + y^2 = 0$ to Clairaut's form by the substitution $y = u, xy = v$. Hence solve the equation and prove that $y + 4x = 0$ is a singular solution. 5
- (b) Solve : $(3x^2 y^4 + 2xy) dx + (2x^3 y^3 - x^2) dy = 0$ 5
- (c) Solve : $y + px = p^2 x^4$ 5
5. (a) Find the singular solution of the differential equation
- $y = px + \sqrt{a^2 p^2 + b^2}, p = \frac{dy}{dx}$ 5
- (b) Solve : $(x^2 y^2 + xy + 1) y dx - (x^2 y^2 - xy + 1) x dy = 0$ 5
- (c) Eliminate the three arbitrary constants a, b, c from the relation $z = ax + by + cxy$. 5

6. (a) Solve the following system of simultaneous equations : 5

$$\frac{dy}{dx} + 2y - 3z = x$$

$$\frac{dz}{dx} + 2z - 3y = e^{2x}$$

- (b) Solve : $\cos x \frac{dy}{dx} - y \sin x = y^2$ 5

- (c) Obtain the general and singular solution of $y = px + p - p^2$ where $p = \frac{dy}{dx}$. 5

7. (a) Find the eigenvalues and eigenfunctions of $\frac{d}{dx} \left(x \frac{dy}{dx} \right) + \frac{\lambda}{x} y = 0$ ($\lambda > 0$) under boundary conditions $y(1) = 0$ and $y(e^\pi) = 0$. 5

- (b) Solve by Lagrange's method of solution $x(y-z)p + y(z-x)q = z(x-y)$ 5

- (c) Solve : $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^2 + e^{3x}$. 5

8. (a) Find a complete integral of the following partial differential equation by using Charpit's method $z = px + qy + p^2 + q^2$. 5

- (b) Solve : $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 6y = 6x^5$ 5

- (c) Solve : $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$ 5
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