THE VIDYARTHI

6319

B. A./B. Sc. (Third Semester) EXAMINATION, 2017-18

MATHEMATICS

Paper Second

(Differential Equation)

Time: Three Hours] [Maximum Marks: 75

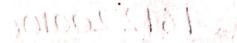
Note: There are three Sections A, B and C in this paper. Section A is compulsory. Attempt any four questions from Section B and any two questions from Section C. Marks allotted to each question are indicated against them. Answer the questions in serial order as far as possible.

Section—A $1\frac{1}{2}$ each

1. (a) Order and degree of the differential equation

$$\left(\frac{d^2y}{dx^2}\right)^3 - 2\frac{dy}{dx} + 6y = x^5 \text{ are respectively :}$$

- (i) 3, 2
- (ii) 2, 3
- (iii) 2, 5
- (iv) 3, 5



- (b) The number of arbitrary constants in the particular solution of a differential equation of second order is:
 - $(i) \quad 0$
 - (ii) 1
 - (iii) 2
 - (iv) 3
- (c) The number of arbitrary constants in the general solution of the differential equation of order four is:
 - (i) 1
 - (ii) 2



- (iii) 3
- (iv) 4
- (d) Which differential equation has $y = C_1e^x + C_2e^{-x}$ as the general solution?

$$(i) \quad \frac{d^2y}{dx^2} + y = 0$$

(ii)
$$\frac{d^2y}{dx^2} - 1 = 0$$

(iii)
$$\frac{d^2y}{dx^2} - y = 0$$

(iv)
$$\frac{d^2y}{dx^2} + 1 = 0$$

(e) Solution of the differential equation $\frac{dy}{dx} = \frac{1}{x} \cot y$

is:

- (i) $x \cos y = C$
- (ii) $y \cos x = C$
- (iii) $y = \cos x$
- (iv) $y = \log x \cdot \cos x$
- (f) Integrating factor of the differential equation $(xy^3 + y)dx + 2(x^2y^2 + x + y^4)dy = 0$ is:
 - (i) y^2
 - (ii) $\frac{1}{y}$

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- (iii) y
- (iv) y^3
- (g) The differential equation of the form $y = x \cdot F(p) + f(p)$ is known as:
 - (i) Lagrange's equation
 - (ii) Clairaut's equation
 - (iii) Total differential equation
 - (iv) Homogeneous equation
- (h) To find the singular solution of a differential equation, we use:
 - (i) c-discriminant relation
 - (ii) p-discriminant relation
 - (iii) Both (i) and (ii)
 - (iv) None of these

| | | A solution, which cannot be obtained general solution by assigning some part value of arbitrary constant is known as: (i) Particular solution (ii) Singular solution (iii) Integrating factor | from icular |
|---|------|--|--|
| | (j) | (ii) Integrating (iv) Complementary function (iv) Complementary function The complete primitive can be obtained by: | The state of the s |
| | | (i) P. I. (ii) C. F. | |
| | | (iii) C. F. + P. I. (iv) None of these Section—B | |
| | (a) | Find the differential equation of the fami curves $y = Ae^{2x} + Be^{-2x}$, where A and E | arc |
| | | parameters. | |
| | (b) | Solve: | $3\frac{1}{2}$ |
| | | $\frac{dy}{dx} = (4x + y + 1)^2$ | |
| | Sol | vo : | $7\frac{1}{2}$ |
| • | 501 | $xyp^2 - (x^2 + y^2)p + xy = 0$ | |
| | Fine | d the orthogonal trajectories of $x^2 + y^2 = 2ax$. | $7\frac{1}{2}$ |
| • | (a) | Solve: | 3 1/2 |
| | (b) | $(D^{3} + 6D^{2} + 11D + 6)y = 0$ Solve: $(D^{2} - 2D + 4)y = e^{x} \cos x$ | 4 |
| | | | |

6. Solve:

 $7\frac{1}{2}$

$$x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 6y = x$$

7. (a) Solve:

3 1/2

$$\frac{dx}{dt} = -wy$$

$$\frac{dy}{dt} = wx$$
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(b) Solve:

4

$$\frac{dx}{y^2 + z^2 - x^2} = \frac{dy}{-2xy} = \frac{dz}{-2xz}$$

8. (a) Show that the curve in which the angle between the tangent and the radius vector at any point is half of the vector angle is a cardioid.

(b) Solve: $yz \log z \, dx - zx \log z \, dy + xy \, dz = 0$

9. Solve:

$$\frac{d^2y}{dx^2} - 2\tan x \frac{dy}{dx} + 5y = 0$$
Section—C

10. (a) Solve:

7 1

$$(1+x^2)\frac{dy}{dx} + 2xy = \cos x$$

(b) Find the singular solution of $y = px + \sqrt{b^2 + a^2 p^2}$. $7\frac{1}{2}$

11. (a) Solve:

 $7\frac{1}{2}$

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

(b) Solve:

71/2

$$x^{2} \frac{d^{2}y}{dx^{2}} + 3x \frac{dy}{dx} + y = \frac{dx}{(1-x)^{2}}$$

12. (a) Solve:

 $7\frac{1}{2}$

$$(D^2 - 3D + 2)y = e^{5x}$$

- (b) Determine C_1 and C_2 so that $y(X) = C_1 e^{2E} + C_2 e^X + 2 \sin X$ will satisfy the conditions y(0) = 0 and y'(0) = 1. $7\frac{1}{2}$
- 13. (a) Solve:

 $7\frac{1}{2}$

$$(2x+y+3)dx = (2y+x+1)dy$$

(b) Solve:

 $7\frac{1}{2}$

$$(D^3 + 3D^2 + 3D + 1)y = e^{-x}$$

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