

**B.SC. MATHEMATICS
THIRD SEMESTER
DIFFERENTIAL EQUATION
BMT – 931 IDMJ [REPEAT]
[USE OMR FOR OBJECTIVE PART]**

2025/11

**SET
A**

Duration: 3 hrs.

Full Marks: 70

Time: 30 min.

[Objective]

Marks: 20

Choose the correct answer from the following:

$1 \times 20 = 20$

1. General form of higher order and first degree equation is

$P^n + A_1 P^{n-1} + A_2 P^{n-2} + \dots + A_{n-1} P + A_n = 0,$

- a. where $A_1, A_2, \dots, A_n$ are some function of x only

$P^n + A_1 P^{n-1} + A_2 P^{n-2} + \dots + A_{n-1} P + A_n = 0,$

- b. where $A_1, A_2, \dots, A_n$ are some function of x and y

$P^n + A_1 P^{n-1} + A_2 P^{n-2} + \dots + A_{n-1} P + A_n = 0,$

- c. where $A_1, A_2, \dots, A_n$ are some function of y only

$P^n + A_1 P^{n-1} + A_2 P^{n-2} + \dots + A_{n-1} P = 0,$

- d. where $A_1, A_2, \dots, A_n$ are some function of x and y

2. Derivative of x w.r.to x is

a. 1

b. 0

c. x

d. $2x$

3. Solution of $\frac{dy}{dx} = (x+y)^2$ is

a. $x+y = \tan^{-1}(x+c)$, where x is the arbitrary constant

b. $(x+y)^2 = \tan(x+c)$, where x is the arbitrary constant

c. $x+y = \tan(x+c)$, where x is the arbitrary constant

d. $x-y = \tan(x+c)$, where x is the arbitrary constant

4. Solution of $x^2 \frac{dy}{dx} + y = 1$ is

a. $y = 1 + ce^x$

b. $y = 1 + ce^{\frac{1}{x}}$

c. $y = 1 - ce^{\frac{1}{x}}$

d. $y^2 = 1 + ce^{\frac{1}{x}}$

5. The complementary function of the differential equation $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} - 4y = 0$ is
- $y = c_1 e^{2x} + c_2 e^{2x}$, where c_1 & c_2 are arbitrary constant
 - $y = c_1 e^{2x} + xc_2 e^{2x}$, where c_1 & c_2 are arbitrary constant
 - $y = c_1 e^{2x} - xc_2 e^{2x}$, where c_1 & c_2 are arbitrary constant
 - $y = c_1 e^{-x} + c_2 e^{4x}$, where c_1 & c_2 are arbitrary constant
6. A Differential equation is said to be linear if
- The independent variable and all its derivative occur in the first degree.
 - The dependent variable and all its derivative occur in the first degree.
 - The dependent variable and all its derivative occur in the second degree.
 - The independent variable and all its derivative occur in the second degree.
7. The Differential Equation $Mdx + Ndy = 0$ is known
- First order and first degree DE
 - First order and 2nd degree DE
 - Homogeneous
 - LDE
8. Solution of a differential equation $\frac{d^2 y}{dx^2} - 5\frac{dy}{dx} + 6y = \sin 3x$ is
- $y = c_1 e^{3x} + c_2 e^{4x}$
 - $y = c_1 e^{-3x} + c_2 e^{4x}$
 - $y = c_1 e^{2x} + c_2 e^{3x} + \frac{1}{78}(5 \cos 3x - \sin 3x)$
 - $y = c_1 e^{3x} + c_2 e^{-4x} + (5 \cos 3x - \sin 3x)$
9. Solution of $(1 - x^2)(1 - y)dx = xy(1 + y)dy$ is
- $\{x(1 - y)^2\} = \frac{1}{2}x^2 - \frac{1}{2}y^2 - 2y + c$
 - $\{x(1 - y)^2\} = \frac{1}{2}x^2 + \frac{1}{2}y^2 - 2y + c$
 - $\log\{x(1 - y)^2\} = \frac{1}{2}x^2 + \frac{1}{2}y^2 - 2y + c$
 - $\log\{x(1 - y)^2\} = \frac{1}{2}x^2 - \frac{1}{2}y^2 - 2y + c$

10. In a LDE of second order with constant coefficient, if $m = a, a$ then C.F. = ?
- $c_1 e^{ax} + x c_2 e^{ax}$
 - $e^{ax}(c_1 \cos bx + c_2 \sin bx)$
 - $c_1 e^{ax} + x c_2 e^{ax} + c_3$
 - $e^{-ax}(c_1 \cos bx + c_2 \sin bx)$
11. General solution of a linear differential equation with constant coefficient is
- Only C.F
 - $y = C.F + P.I$
 - Only P.I
 - None of the above
12. The Single comined solution of $P^2 - 7P + 15 = 0$ is
- $(y - 3x - c)(y + 4x - c) = 0$
 - $(y + 3x - c)(y - 4x - c) = 0$
 - $(y - 3x - c)(y - 4x - c) = 0$
 - $(y + 3x - c)(y + 4x - c) = 0$
13. $\frac{dy}{dx} + Py = Qy^n$, P & Q are function of x alone is known as
- Linear DE of first order
 - Linear DE of second order
 - Higher order DE
 - Bernouli's Equation
14. Singular Solution of $y + px = p^2 x^4$ is
- $4y = -x^2$
 - $4y = -x$
 - $4y = x^2$
 - $4y = x$
15. General solution of $(y - px)(p - 1) = p$ is
- $y = cx^2 + \frac{c}{c-1}$
 - $y = cx + \frac{c}{c-1}$
 - $y = cx + \frac{c^2}{c-1}$
 - $y = cx + \frac{c}{c+1}$
16. A Family of curves $y = Ae^x + Be^{-x}$, for different values of A and B given. The differential Equation is
- $\frac{d^2 y}{dx^2} = -y$
 - $\frac{d^2 y}{dx^2} = y$
 - $\frac{dy}{dx} = y$
 - $\frac{d^2 y}{dx^2} = y^2$

17. A Clairaut's form of a DE can be written as

- a. $y = px + f(p)$, where $p = \frac{dy}{dx}$
- b. $y = px + f(p)$, where $p = \frac{dx}{dy}$
- c. $y = p^2 x + f(p)$, where $p = \frac{dy}{dx}$
- d. $y = px + xf(p)$, where $p = \frac{dy}{dx}$

18.

The Integrating Factor(I.F) of $x \frac{dy}{dx} + y = x^2 + 3x + 2$ is

- a. e^x
- b. e^{-x}
- c. x
- d. x^2

19. A Differential Equation of the form

$\frac{dy}{dx} = \frac{f_1(x, y)}{f_2(x, y)}$, where $f_1(x, y)$ and $f_2(x, y)$ are homogeneous function of x and y of the second degree is called

- a. Linear DE
- b. Exact DE
- c. Homogeneous Equation
- d. Ordinary Differential Equation

20.

$y = -\frac{1}{4}x^2$ is a singular solution of a Differential equation $y' = -px + p^2x^4$

where general solution is $xy = c^2x - c$

- a. Because it does not contain any arbitrary variable and it cannot be obtained from the general solution.
- b. Because it does not contain any arbitrary constant and it can be obtained from the general solution.
- c. Because it does not contain any arbitrary constant and it cannot be obtained from the general solution.
- d. Because it has arbitrary constant and it cannot be obtained from the general solution.

(Descriptive)

Time : 2 hrs. 30 mins.

Marks: 50

[Answer question no.1 & any four (4) from the rest]

1. What do you mean by Differential Equation which is first order but not of the first degree. Solve 2+8=10

$$p^2 + 2p \cot x = y^2$$

2. What is the singular solution. What is P-discriminant relation. Find the general and singular solution of 1+5+4=10

(a) $y^2 - 2pxy + p^2(x^2 - 1) = m^2$

(b) $y = px + \frac{a}{p}$

3. Solve 5+5=10

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

(b) $x(x-1) \left(\frac{dy}{dx} \right) - (x-2)y = x^3(2x-1)$

4. Solve 5+5=10

(a) $\frac{d^2 y}{dx^2} - \frac{dy}{dx} - 2y = \sin 2x$

(b) $(D^3 + 1)y = (e^x + 1)^2$

5. (a)

4+6=10

$$\frac{d^4 y}{dx^4} - 2 \frac{d^3 y}{dx^3} + 5 \frac{d^2 y}{dx^2} - 8 \frac{dy}{dx} + 4y = e^x$$

$$(1 + xy)ydx + (1 - xy)x dy = 0$$

(b)

6. Solve

10

$$(a) y^2 + xyp - x^2 p^2 = 0$$

$$(b) y = 2px + y^2 p^3$$

7. Evaluate and find the required solution of the following

5+5=10

$$(a) (2x + y - 3)dy = (x + 2y - 3)dx$$

$$(b) (x + 2y - 2)dx + (2x - y + 3)dy = 0$$

8. What is the method of solving Linear differential equation of first order. Find the solution of the following

5+5=10

$$(a) (1 + x) \frac{dy}{dx} - xy = 1 - x$$

$$(b) \frac{dy}{dx} + xy = xy^5$$

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