REV-01
MSM/25/30

2023/12

SET A

M.Sc. MATHEMATICS
FIRST SEMESTER
DIFFERENTIAL EQUATION I
MSM – 105

[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

(Objective)

Time: 15 mins. **Marks: 10**

Choose the correct answer from the following: ***1×10=10***

1. An equation of the form $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R$, where P, Q, R are functions of x only is known as
   a. LDE with constant coefficient
   b. LDE with variable coefficient
   c. LDE of First Order
   d. Homogeneous of First Order

2. Solution of this equation $yz\log z dx - zx\log z dy + xy dz = 0$ is
   a. $x\log y = cz, c$ is constant
   b. $x\log z = cy, c$ is constant
   c. $\log z = cxy, c$ is constant
   d. None of the above

3. In Removal of First Derivative Method
   a. $X = Q + \frac{1}{2}\frac{dP}{dx} - \frac{1}{4}P^2$
   b. $X = Q - \frac{1}{2}\frac{dP}{dx} + \frac{1}{4}P^2$
   c. $X = Q - \frac{1}{2}\frac{dP}{dx} - \frac{1}{4}P^2$
   d. $X = -Q - \frac{1}{2}\frac{dP}{dx} - \frac{1}{4}P^2$

4. Solutions of a simultaneous equations $\frac{dx}{y} = \frac{dy}{x} = \frac{dz}{z}$ are
   a. $x^2 - y^2 = c_1, x^2 + y^2 = c_2 z$
   b. $x^2 - y^2 = c_1, x - y = c_2 z$
   c. $x^3 - y^3 = c_1, x + y = c_2 z$
   d. $x^2 - y^2 = c_1, x + y = c_2 z$

5. In a linear differential differential equation with variable coefficients if $2 + 2Px + Qx^2 = 0$ then known integral is
   a. $y = x$
   b. $y = x^2$
   c. $y = e^x$
   d. $y = e^{-x}$

6. Complete primitive of the differential equation $\frac{d^2y}{dx^2} + n^2 y = \sec nx$ is

a. $y = A\cos nx + B\sin nx$, A , B are parameters or function of x.

b. $y = A\cos nx + B\sin nx$, A , B are constant

c. $y = c_1\cos nx + c_2\sin nx$, c_1 , c_2 are constant

d. None of the above

7. In changing independent variable method the value of R_1 is

a. $\frac{R}{\left(\frac{dz}{dx}\right)^2}$

b. $-\frac{R}{\left(\frac{dz}{dx}\right)^2}$

c. $-\frac{R}{\left(\frac{dy}{dx}\right)^2}$

d. $\frac{R}{\left(\frac{dy}{dx}\right)^2}$

8. The simultaneous differential equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$ represents geometrically that

a. A system of curves in space ,the direction cosines of the tangent at any point (x, y, z) are parallel to P, Q, R.

b. A system of curves in space ,the direction ratio of the tangent at any point (x, y, z) are proportional to P, Q, R.

c. A system of curves in space ,the direction cosines of the tangent at any point (x, y, z) are proportional to P, Q, R.

d. None of the above

9. Condition of exactness of a total differential equation is

a. $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}, \frac{\partial Q}{\partial z} = \frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$

b. $\frac{\partial P}{\partial y} = -\frac{\partial Q}{\partial x}, \frac{\partial Q}{\partial z} = \frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$

c. $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}, \frac{\partial Q}{\partial z} = \frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = -\frac{\partial P}{\partial z}$

d. $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}, \frac{\partial Q}{\partial z} = -\frac{\partial R}{\partial y}, \frac{\partial R}{\partial x} = \frac{\partial P}{\partial z}$

10.

An equation of the form $Pdx + Qdy + Rdz = 0$, where are functions of P, Q, R x only known as

a. Total Differential Equation
b. Simultaneous Differential Equation
c. Linear Differential Equation
d. None of the above

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(Descriptive)

Time : 1 hr. 15 min. Marks : 25

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

1. Solve by variation of Parameter 5

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

2. What are the normal form of Removal of First Derivative method?Write the special formula of X, Y 1+2+7 =10

Solve by Known Integral Method

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

3. Solve 5+5=10

(a) $\frac{dx}{dt} - 7x + y = 0$

$\frac{dy}{dt} - 2x - 5y = 0$

(b) $\frac{dx}{mz - ny} = \frac{dy}{nx - lz} = \frac{dz}{ly - mx}$.

4. If the total differential equation $Pdx + Qdy + Rdz = 0$ is integrable ,Prove that 10

$$P\left(\frac{\partial Q}{\partial z} - \frac{\partial R}{\partial y}\right) + Q\left(\frac{\partial R}{\partial x} - \frac{\partial P}{\partial z}\right) + R\left(\frac{\partial P}{\partial y} - \frac{\partial Q}{\partial x}\right) = 0$$

5. (a) Find $f(y)$ if $f(y)dx - zxdy - xy \log ydz = 0$ is integrable.Find the corresponding integral. 2+8=10

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