2023/01

SET A

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

[USE OMR SHEET FOR OBJECTIVE PART]

Duration : 1.30 hrs. **Full Marks : 35**

Objective

Time: 15 min. **Marks: 10**

Choose the correct answer from the following: ***1X10=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
   a. y only
   b. x only
   c. z only
   d. None of above

2. If $y = e^x$ is a part of complementary function if
   a. $1 - P + Q = 0$
   b. $1 + P + Q = 0$
   c. $P + Qx = 0$
   d. $1 + 2PQ + Q^2 = 0$

3. Given $y = Ax + \frac{B}{x}$ be the complete primitive of the equation

   $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = x^2e^x$,where A, B are
   a. Arbitrary constant
   b. Functions of x only
   c. Functions of x, y respectively
   d. None of the above

4. An equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$,where P, Q, R are functions of x, y, z is called
   a. Simultaneous differential equation
   b. Total differential equation
   c. Linear Differential Equation
   d. Linear Differential Equation of 2nd order

5. The geometrical interpretation of simultaneous differential equation is that
   a. The simultaneous equation represents a system of curves in plane,the direction cosines of the tangent to any member of this system at any point are proportional to P, Q, R

b. The simultaneous equation represents a system of curves in space,the direction ratios of the tangent to any member of this system at any point are proportional to P, Q, R

c. The simultaneous equation represents a system of curves in plane,the direction ratios of the tangent to any member of this system at any point are proportional to P, Q, R

d. The simultaneous equation represents a system of curves in space,the direction cosines of the tangent to any member of this system at any point are proportional to P, Q, R

6. In the Removal of first derivative Method what is the value of u of the following equation $\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + (4x^2 - 1)y = -3e^{x^2}\sin 2x$ is

a. e^x
b. e^{-x^2}
c. e^{x^2}
d. none of these

7. An equation of the form $Pdx + Qdy + Rdz = 0$,where P, Q, R are functions of x, y, z is called
   a. Total Differential Equation
   b. Simultaneous Differential Equation
   c. Linear Differential Equation
   d. None of the above

8. Condition of Exactness is

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

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

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

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

9. The A.E of the equation

$3x^2dx+3y^2dy-\left(x^3+y^3+e^{2z}\right)dz=0$ is

a. $\frac{dx}{3y^2}=\frac{dy}{3x^2}=\frac{dz}{0}$

b. $\frac{dx}{-3y^2}=\frac{dy}{3x^2}=\frac{dz}{0}$

c. $\frac{dx}{3y^2}=\frac{dy}{-3x^2}=\frac{dz}{0}$

d. none of the above

10. If the equation $f(y)dx-zxdy-xy\log ydz=0$ is integrable then $f(y)=?$

a. $f(y)=kx$

b. $f(y)=-ky$

c. $f(y)=kz$

d. $f(y)=ky$

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Descriptive

Time : 1 hrs. 15 mins. **Marks : 25**

[Answer question no.1 & any two (2) from the rest]

1. Solve by Variation of Parameter **5**

$$\frac{d^2y}{dx^2} + n^2 y = Secnx$$

2. What do you mean by normal form of a linear differential equation of 2nd order?Solve by Removal of first derivative method **2+8=10**

$$\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + \left(4x^2 - 1\right)y = -3e^{x^2} Sin2x$$

3. What do you mean by Total Differential Equation?Show that **1+9=10**

$P\left(\frac{\partial Q}{\partial z} - \frac{\partial R}{\partial y}\right) + Q\left(\frac{\partial R}{\partial x} - \frac{\partial P}{\partial z}\right) + R\left(\frac{\partial P}{\partial y} - \frac{\partial Q}{\partial x}\right) = 0$ if the total differential Equation is integrable.

4. Solve **5+5=10**

(a)

$$\frac{dx}{dt} + 4x + 3y = t$$

$$\frac{dy}{dt} + 2x + 5y = e^t$$

(b)

$$\left(\frac{d}{dt} + 2\right)x + 3y = 0$$

$$3x + \left(\frac{d}{dt} + 2\right)y = 2e^{3t}$$

5. What is Geometrical Interpretation of **2+4+4 =10**

$$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$$

Solve

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

(b) $\frac{adx}{(b-c)yz} = \frac{bdy}{(c-a)zx} = \frac{cdz}{(a-b)xy}$

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