CHAPTER 9  DIFFERENTIAL EQUATIONS

1. MARK QUESTIONS

Q1. Find the order and degree of the differential equation:
   (a) \( \left( \frac{d^2y}{dx^2} \right)^3 + \left( \frac{dy}{dx} \right)^2 + \sin \left( \frac{dy}{dx} \right) + 1 = 0 \)
   (b) \( (y'')^2 + (y''')^3 + (y')^4 + y^5 = 0 \)

Q2. Form the differential equation representing the family of curves \( y = mx \) where \( m \) is arbitrary constant.

2. 4 MARKS QUESTIONS

Q1. Form the differential equation representing the given family of curves by eliminating arbitrary constants \( a \) and \( b \):
   (a) \( y^2 = a \left( x^2 - x^2 \right) \)
   (b) \( y = ae^{3x} + be^{-2x} \)

Q2. Find the general solution of the following differential equations:
   a) \( (e^x + e^{-x}) \, dy - (e^x - e^{-x}) \, dx = 0 \)
   b) \( \sec^2 x \tan y \, dx + \sec x \tan x \, dy = 0 \)
   c) \( (1 + x^2) \, dy + 2xy \, dx = \cot x \, dx \) \( (x \neq 0) \)
   d) \( y \, dx - (x + 2y^2) \, dy = 0 \)
   e) \( ye^{xy} \, dx = \left( xe^{xy} + y^2 \right) \, dy \) \( ; \ y \neq 0 \)
as show that the differential equation is homogeneous and solve it.

\[ x \cos \left( \frac{y}{x} \right) \frac{dy}{dx} = y \cos \left( \frac{y}{x} \right) + x. \]

Q4. Solve the initial value problems:

a) \((x^3 + x^2 + x + 1) \frac{dy}{dx} = 2x^2 + x, \quad y = 1 \text{ if } x = 0.\)

b) \(\frac{dy}{dx} + \frac{y}{x} + \csc \left( \frac{y}{x} \right) = 0, \quad y = 0 \text{ if } x = 1.\)

c) \(\frac{dy}{dx} + y \cot x = 2x + x^2 \text{ (} x \neq 0 \text{) given that } y = 0 \text{ when } x = \pi/2.\)