

# School of Basic and Applied Sciences

Chemistry  
ETE - Jun 2023

Time : 3 Hours

Marks : 100

## Sem IV - C1UC401T - Differential Equations and Mechanics

Your answer should be specific to the question asked

Draw neat labeled diagrams wherever necessary

1. K1 CO2 (5)  
Solve the homogeneous PDE:  $(D^2 - 2DD' + D'^2)z = 0$ .
2. K1 CO1 (5)  
Find the partial differential equation by eliminating arbitrary constants  $a$ ,  $b$  and  $c$  from the following equation  $z = ax^2 + bxy + cy^2$ .
3. K2 CO1 (5)  
Solve the given PDE:  $p + q = 1$
4. K3 CO3 (10)  
Solve the given PDE:  $p + 7q = 2z + \cot(y - 7x)$  by using Lagrange's method.
5. K4 CO3 (10)  
Solve the given partial differential equation:  $(D + 1)(D + D' - 1)z = \sin(x + 2y)$ .
6. K2 CO2 (10)  
If the distance  $S$  of a particle from the origin, moving in a straight line is given by  $S = a \sin t + b \cos t$ . Find the velocity and acceleration of the particle.
- 7) K3 CO4 (10)  
Solve the non-homogeneous PDE:  $(D^2 - 4D'^2 - 4DD')z = e^{2x+y}$ .

**OR**

K3 CO4 (10)

By using Lagrange's method, Solve the equation:

$$x(y^2 + z)p - y(x^2 + z)q = z(x^2 - y^2)$$

- 8) K4 CO4 (15)  
By using the method of separation of variables, solve the given PDE  $u_x + u_t = 0$ , with the initial condition  $u(x, 0) = 100e^{-5x}$ .

**OR**

A particle describes the curve  $r = ae^{m\theta}$  with constant velocity. Find the components of velocity and acceleration along the radius vector and perpendicular to it. K4 CO4 (15)

9. K4 CO3 (15)

Show that  $x = 0$  and  $x = -1$  are singular points of  $x^2(x + 1)^2y'' + (x^2 - 1)y' + 2y = 0$ , where the first is irregular and other is regular.

10. K3 CO4 (15)

Write the formula of Charpit Method. Also, Solve the equation:  $p^2 + qy = z$ .