UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program : Third Semester - Fall 2021

Paper: Differential Equations-I Course Code: MATH-221

Roll No.

Time: 3 Hrs. Marks: 60

Q.1. Solve the following:

(6x5=30)

- (i) Solve by any appropriate method $2xy\frac{dy}{dx} = y^2 x^2$.
- (ii) Solve the initial value problem $(x^4 + y^2)dx = xydy$, y(2) = 1.
- (iii) Find the particular solution $\frac{dr}{d\theta} = b \left[\cos\theta \, \frac{dr}{d\theta} + r \sin\theta \right], \, r \left(\frac{\pi}{2} \right) = \pi, 0 < b < 1.$
- (iv) Find a general solution $\frac{d^2y}{dx^2} + 9y = 18x + 36 \sin 3x.$
- (v) Solve the nonhomogeneous ODE $\frac{d^2y}{dx^2} + y = \sec x$.
- (vi) Find the general solution $\frac{dy}{dx} + x^2y = e^{-x^3} \sinh x$.

Q.2. Solve the following:

(3x10=30)

(i) Solve the nonhomogeneous Euler-Cauchy equation

$$x^{3}\frac{d^{3}y}{dx^{3}} - 3x^{2}\frac{d^{2}y}{dx^{2}} + 6x\frac{dy}{dx} - 6y = x^{4}\ln x, \quad x > 0.$$

(ii) Find an integrating factor and solve the problem

$$(e^{x+y} + ve^y)dx + (xe^y - 1)dy = 0, \quad y(0) = -1.$$

(iii) Solve the initial value problem

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{0.5x} + 40\cos 10x - 190\sin 10x,$$

$$y(0) = 0.16$$
, $\frac{dy}{dx}(x = 0) = 40.08$.