

Section A. Answer 2 questions.

A1 Find the general solution of  $\frac{dy}{dx} + 3y = 4e^{-2x}$ . [6]

A2 Find the general solution of  $\frac{dy}{dx} - xy = x$ . [6]

A3 Find the general solution of  $\frac{dy}{dx} = -y \tan x$  [6]

Section B. Answer 2 questions.

B1 Find the general solution of  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = 0$ . [5]

B2 Find the general solution of  $4\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 45y = 0$ . [5]

B3 Find the general solution of  $4\frac{d^2y}{dx^2} - 20\frac{dy}{dx} + 25y = 0$ . [5]

Section C. Answer 2 questions.

C1 Find the general solution of  $4\frac{d^2y}{dx^2} - y = -x^2 + 2x + 11$ . [8]

C2 Find the general solution of  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = e^{-3x}$ . [8]

C3 Find the general solution of  $\frac{d^2y}{dx^2} + 4y = 10\cos 3x - 15\sin 3x$ .

[8]

Section D. Answer 1 question.

D1 Find the solution of  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 5e^{-4x}$ , given that when  $x = 0$ ,

$\frac{dy}{dx} = -8$ , and  $y$  remains finite for large  $x$ . [12]

D2 Find the solution of  $2\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = 10x^2 + 3x + 9$ , given that when

$x = 0$ ,  $y = -2$  and  $\frac{dy}{dx} = 9/2$ . [12]

**D.E. 2009-10 Answers**

A1  $\frac{dy}{dx} + 3y = 4e^{-2x}$

Use characteristic equation or integrating factor to get

$$y = Ae^{-3x} + 4e^{-2x}$$

A2  $\frac{dy}{dx} - xy = x$

Use integrating factor or separation of variables to get

$$y = Ce^{-x^2/2} - 1$$

A3  $\frac{dy}{dx} = -y \tan x$

Use integrating factor or separation of variables to get

$$y = C \cos x$$

B1  $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 8y = 0$

$$y = Ae^{2x} + Be^{-4x}.$$

B2  $4\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 45y = 0$

$$y = e^{3x/2}(A \cos 3x + B \sin 3x).$$

B3  $4\frac{d^2y}{dx^2} - 20\frac{dy}{dx} + 25y = 0$

$$y = (A + Bx)e^{5x/2}.$$

C1  $4\frac{d^2y}{dx^2} - y = -x^2 + 2x + 11$

$$y = Ae^{x/2} + Be^{-x/2} + x^2 - 2x - 3.$$

C2  $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y = e^{-3x}$

$$y = Ae^{2x} + (B - x/5)e^{-3x}.$$

C3  $\frac{d^2y}{dx^2} + 4y = 10 \cos 3x - 15 \sin 3x$

$$y = A \cos 2x + B \sin 2x - 2 \cos 3x + 3 \sin 3x$$

$$\text{D1 } \frac{d^2 y}{dx^2} + \frac{dy}{dx} - 2y = 5e^{-4x}$$

$$y = 3e^{-2x} + (1/2)e^{-4x}$$

$$\text{D2 } 2 \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + 5y = 10x^2 + 3x + 9$$

$$y = e^{-x/2} (\cos(3x/2) + 4 \sin(3x/2)) + 2x^2 - x - 3.$$