Tutorial Sheet - 9 AUTUMN 2019

MATHEMATICS-I(MA10001)

1. Solve the following differential eqautions:

(a) $(x^2D^2 - 4xD + 6)y = x^4$

(b) $(x^3D^3 + x^2D^2 - 2)y = x - \dfrac{1}{x^3}$

(c) $(x^2D^2 + 4xD + 2)y = e^x$

(d) $(x^2D^2 + 3xD + 1)y = \dfrac{1}{(1-x)^2}$

(e) $(x^3D^3 + x^2D^2)y = x$

(f) $(x^2D^2 + xD + 1)y = (\log x)\sin(\log x)$

(g) $(x^2D^2 - 3xD + 5)y = x\log x$

(h) $(x^3D^3 + 2x^2D^2 + 2)y = 10(x + \dfrac{1}{x})$

(i) $(x^2D^2 + 2xD - 20)y = (x+1)^2$

(j) $(x^2D^2 + 4xD + 2)y = x + \sin x$

2. Solve the following differential eqautions:

(a) $(x+a)^2y'' - 4(x+a)y' + 6y = x$

(b) $(1+2x)^2y'' - 6(1+2x)y' + 16y = 8(1+2x)^2$

(c) $(3x+2)^2y'' + 3(3x+2)y' - 36y = 3x^2 + 4x + 1$

3. Apply the method of variation of parameters to solve the following differential eqautions:

(a) $(D^2 + 9)y = \sec 3x$

(b) $(D^2 - 1)y = \dfrac{2}{1+e^x}$

(c) $(D^2 - 2D)y = e^x \sin x$

(d) $(D^2 + 1)y = \mathrm{cosec}^2(x)$

(e) $(D^2 - 2D + 1)y = xe^x \log x$

(f) $(D^2 - 2D + 2)y = e^x \tan x$

4. Find the values of λ for which all solutions of $(x^2D^2 - 3xD - \lambda)y = 0$ tend to zero as $x \to \infty$

5. Solve the following system of differential eqautions:

(a) $\dfrac{dx}{dt} = ax + by, \quad \dfrac{dy}{dt} = bx + ay$

(b) $\dfrac{dx}{dt} + 2y + x = e^t, \quad \dfrac{dy}{dt} + 2x + y = 3e^t$

(c) $\dfrac{dx}{dt} + \dfrac{dy}{dt} + 2x - y = 3(t^2 - e^{-t}), \quad 2\dfrac{dx}{dt} - \dfrac{dy}{dt} - x - y = 3(2t - e^{-t})$

(d) $\dfrac{dx}{dt} + \dfrac{dy}{dt} - 2y = 2cost - 7sint, \quad \dfrac{dx}{dt} - \dfrac{dy}{dt} + 2x = 4cost - 3sint$