# Problem Set - 10

**AUTUMN 2016**

**MATHEMATICS-I (MA10001)**

*September 18, 2016*

1. Using method of Variation of parameters, solve following differential equations:

   (a) $y'' + 4y = 4\tan 2x$

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

   (c) $y'' - 3y' + 2y = \frac{e^x}{1+e^x}$

   (d) $y'' - 2y' = e^x \cos x$

2. Solve the Euler's equations:

   (a) $(D^2 + \frac{1}{x}D)y = \frac{12 \ln x}{x^2}$

   (b) $(x^4D^3 + 2x^3D^2 - x^2D + x)y = 1$

   (c) $(x^2D^2 - 3xD + 5)y = x^2 \sin(\ln x)$

   (d) $(x^4D^4 + 6x^3D^3 + 9x^2D^2 + 3xD + 1)y = (1 + \ln x)^2$

   (e) $(x^2D^2 - 3xD + 1)y = \frac{\ln x \sin(\ln x)+1}{x}$

3. Solve the following system of differential equations:

   (a) $\dfrac{dx}{dt} - 3x - 4y = 0,\ \dfrac{dy}{dt} + x + y = 0$

   (b) $\dfrac{dy}{dx} + y = 2 + e^x,\ \dfrac{dz}{dx} + z = y + e^x$

   (c) $\dfrac{dx}{dt} + 4x + y = te^{3t},\ \dfrac{dy}{dt} + y - 2x = \cos^2 t$

   (d) $\dfrac{dx}{dt} + 2\dfrac{dy}{dt} - 2x + 2y = 3e^t,\ 3\dfrac{dx}{dt} + \dfrac{dy}{dt} + 2x + y = 4e^{2t}$

4. Solve the following differential equations:

   (a) $u'' + 6u' + 10u = \cos 2x,\ u(0) = 0,\ u'(0) = 0$

   (b) $u'' - 16u = 2e^{4x},\ u(0) = 0,\ u'(0) = 0$

   (c) $u^{(3)} + 2u^{(2)} - 6u^{(1)} + 2u = 0$

   (d) $u^{(4)} - u^{(3)} = e^{2x}$

   (e) $u^{(2)} - 2u^{(1)} + 2u = x^2e^x$

   (f) $xy'' - y' = (1 + x)x$

   (g) $y'' + 4y' + 4y = \frac{e^{-2x}}{x^2},\ y(1) = \frac{1}{e},\ y'(1) = -\frac{2}{e^2},\ y_p = -e^{-2x}\ln x$

   (h) $y'' + 3y' - 4y = 8\sin 2x + 6\sin 2x$

   (i) $x^2y'' - 4xy' + 6y = 21x^{-4}$

   (j) $y''' - 4y'' + 5y' - 2y = 2x + 3$

5. Solve the following differential equations:

   (a) $(D^2+1)y = x^2 \sin 2x$

   (b) $(D^3 - D^2 + 3D + 5)y = e^x \cos 2x$

   (c) $(D^3 - D^2 - 6D)y = 1 + x^2$

   (d) $(D^4 - 2D^2 + 1)y = \cos x$

   (e) $(D^3 + D^2 + D + 1)y = \sin 2x$

   (f) $(D^2 - 2D + 1)y = (1 + e^{-x})^2$

   (g) $(3D^2 - 4D + 5)y = e^x - 2e^{2x} + 3e^{3x}$

   (h) $(D^2 - 4)y = 3e^{2x} - 4e^{-2x}$