King Fahd University of Petroleum & Minerals
Department of Mathematics & Statistics
Math 202 Major Exam 2
The First Semester of 2011-2012 (111)

Q:1 Consider the differential equation

$$y'' + 3y = -18e^{3x} \qquad (1)$$

(a) (5 points) Verify that $y_1 = \cos\sqrt{3}x$ and $y_2 = \sin\sqrt{3}x$ are solutions of $y'' + 3y = 0$.

(b) (5 points) Find a particular solution of the differential equation (1).

(c) (2 points) Write the general solution of the differential equation (1).

Q:2 (16 points) Find the general solution of the differential equation

$$xy'' - y' + 4x^3y = 0$$

given that $y_1 = \sin(x^2)$ is a solution.

Q:3 (16 points) Solve the initial value problem

$$y''' + y'' - y' - y = 0; \qquad y(0) = 0, \;\; y'(0) = 0, \;\; y''(0) = 4.$$

Q:4 (a) (8 points) Find a linear differential operator that annihilates the function

$$9x^3 + x^2(1 - 3x)e^{2x} + 5xe^{-2x}\cos 3x$$

(b) (16 points) Solve the differential equation $y'' - 5y' + 6y = 3e^x + 2\sin x$ using undetermined coefficients.

Q:5 (a) (12 points) Use variation of parameters method to find a particular solution of

$$(x^2-1)y'' - 2xy' + 2y = (x^2-1)^2$$

given that a complementary function is $y_c = c_1 x + c_2(1+x^2)$.

(b) (4 points) Write the general solution and find values of c_1 and c_2 using the boundary conditions $y(0) = 0$ and $y(1) = 1$.

Q:6 (16 points) Find the general solution of

$$4x^2y'' + 8xy' + y = 4x^{\frac{3}{2}}$$