

ENGR 213, Section UB, Fall Semester 2017, Midterm Test 2

**Problem 1.** Solve the given differential equations

(a)  $12y'' - 3y' - 9y = 0$

(b)  $y'' + 2y' + 2y = 0$

**Problem 2.** Solve the following initial-value problem:

$$y'' + 6y' + 9y = e^{-3t} \quad y(0) = -5, y'(0) = -3$$

by using the method of undetermined equation.

**Problem 3.** Solve the given differential equations

(a)  $x^2 y'' + xy' + 4y = 0$

(b)  $x^2 y'' - 3xy' + 4y = 0$

**Problem 4.** Solve the following initial-value problem:

$$t^2 y'' - 2ty' + 2y = t^2 \ln(t) \quad y(1) = 0, y'(1) = 0$$

**Problem 5.** A mass weighing 1 kg with a damping constant 4, stretches a spring 2 m beyond its natural length by a force of 10 newtons. If the spring is stretched 4 m beyond its natural length and then released from rest find an equation of motion. Also, state if the motion is under-damped, critically-damped or over-damped.

**BONUS QUESTION.** Solve the given differential equation

$$\frac{d^2 q}{du^2} - \exp\left(-\frac{dq}{du}\right) = 0$$