50 minutes, no books or notes or phones or ipods, calculator OK.

Note: Test 2 will have just four problems.

(1) Using the $e^{rt}$ method, solve the IVP

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = 0, \quad y(0) = -1, \quad y'(0) = 2$$

(2) Then using the method of undetermined coefficients, find the general solution to

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = 2e^{-t}$$

(3) Underdamped harmonic oscillator: Solve

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = 0$$

using the $e^{rt}$ method. Then impose the initial conditions $y(0) = 0, \ y'(0) = 1$ to find the unique solution $y(t)$ to the initial value problem.

(4) Resonantly forced harmonic oscillator: Solve

$$\frac{d^2y}{dt^2} + 4y = -2\cos(2t)$$

using the method of undetermined coefficients. Be sure to include the homogeneous solution: $y(t) = y_H(t) + y_P(t)$.

(5) Solve the linear boundary value problem

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0, \quad y(0) = 1, \quad y(1) = 0$$

using the $e^{rx}$ method.