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**Ma 221** **Exam II B** **13S**

I pledge my honor that I have abided by the Stevens Honor System.

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**You may not use a calculator, cell phone, or computer while taking this exam. All work must be shown to obtain full credit. Credit will not be given for work not reasonably supported. When you finish, be sure to sign the pledge.**

Note: A table of selected integrals appears on the last page of this exam.

Score on Problem #1a ________

#1b ________

#1c ________

#2 ________

#3a ________

#3b ________

#3c ________

#3d ________

Total Score ________

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**1**. (30 **pts**. **total**) Consider the differential equation

$$L[y] = y'' - 4y' + 5y = 2e^{2t} + \sin t$$

**1 a** (6 **pts**.) Find the solution of the corresponding homogeneous equation

$$L[y] = 0.$$

.

**1 b** (20 **pts**.) Find a particular solution of this equation.

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**1 c** (4 **pts**.) Give a general solution of the equation

$$y'' + 4y' + 5y = 2e^{-2t} + \cos t$$

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**2** (20 **pts**) Find a particular solution of the differential equation

$$y'' + 2y' + 2y = 8t^2$$

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**3** $\big($50 **points total**$\big)$

**3a** $\big($10 **pts**.$\big)$ One solution of the homogeneous equation

$$t^2y'' - ty' + y = 0 \quad t > 0$$

is $y_1(t) = t$. Find a second linearly independent solution of this equation by letting

$$y_2(t) = u(t)t$$

and determining $u(t)$. Show that the two solutions $t$ and $y_2(t)$ are indeed linearly independent.

**3b** $\big($5 **pts**.$\big)$ Give a general solution to the homogeneous equation

$$t^2y'' - ty' + y = 0 \quad t > 0$$

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**3c** (25 **pts**.) Given that $y_1(t) = t$ and $y_2(t) = t\ln t$ are two linearly independent solutions of the homogeneous equation

$$t^2y'' - ty' + y = 0$$

find a particular solution to the equation

$$t^2y'' - ty' + y = t$$

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**3d** (10 **pts**.) Solve the initial value problem

$$t^2 y'' - t y' + y = t \quad y(1) = 1, \quad y'(1) = 4$$

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# Table of Integrals

$$\int \ln t\,dt = t(\ln t - 1) + C$$

$$\int (\ln t)^2 dt = t\left(\ln^2 t - 2\ln t + 2\right) + C$$

$$\int \frac{\ln t}{t} dt = \frac{1}{2}\ln^2 t + C$$

$$\int \frac{(\ln t)^2}{t} dt + C = \frac{1}{3}\ln^3 t + C$$

$$\int \frac{1}{t\ln t} dt = \ln(\ln t) + C$$