MATH 3354-001 Exam III-1 3 May 2013
Make-up

Name _____ Score _____

In-class Exam

Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Work carefully. Do your own work. **Show all relevant supporting steps!** Attach this sheet to the front of your answers.

Part I. (18 pts) Do three (3) of the following four problems:

1. Find the Laplace transform of $f(t)=\begin{cases}1-t & 0<t<4\\ 5 & t>4\end{cases}$

2. Find the Laplace transform of $f(t)=\left(5t^2-e^{-4t}\right)^2$

3. Find the Laplace transform of $f(t)=te^{4t}\cos 7t$

4. Find the Laplace transform of $f(t)=(3t^2+e^{-4t})u(t-5)$

Part II. (18 pts) Do three (3) of the following four problems:

5. Find the following inverse Laplace transform $\mathscr{L}^{-1}\left((\frac{4}{s}-\frac{3}{s^2})^2\right)$

6. Find the following inverse Laplace transform $\mathscr{L}^{-1}\left(\frac{4s-15}{s^2+40}\right)$

7. Find the following inverse Laplace transform $\mathscr{L}^{-1}\left(\frac{7s-9}{s^2-8s+25}\right)$

8. Find the following inverse Laplace transform $\mathscr{L}^{-1}\left\{\frac{e^{-7s}}{(s-3)(s+4)}\right\}$

Part III. (50 pts) Do five (5) of the following six problems:

9. Use the method of Laplace transforms to solve the following linear differential equation

$$y' + 5y = -3$$
$$y(0) = -2$$

10. Use the method of Laplace transforms to solve the following linear differential equation

$$y'' - 8y' + 15y = 0$$
$$y(0) = -2, y'(0) = 3$$

11. Use the method of Laplace transforms to solve the following linear differential equation

$$y'' - 8y' + 16y = 6$$
$$y(0) = -1, y'(0) = 1$$

12. Use the method of Laplace transforms to solve the following linear differential equation

$$y'' - 6y' + 8y = u(t-5)$$
$$y(0) = 0, \quad y'(0) = 0$$

13. Use the method of Laplace transforms to solve the following linear differential equation

$$y'' + 16y = \cos 2t$$
$$y(0) = 0, y'(0) = 3$$

14. Use the method of Laplace transforms to solve the following linear differential equation

$$y'' + 25y = \delta(t-4)$$
$$y(0) = 2, y'(0) = -4$$

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Take-Home Exam

Answer the problems on this sheet of paper. Work carefully. Do your own work. **Show all relevant supporting steps!**

15. (6 pts) A mass weighing 18 lbs is attached to a spring and stretches the spring 24 inches. The mass is released at a point 3 inches below the equilibrium position with an initial downward velocity of 9 inches/sec. Find the equation of motion.

Answer the next problem on the back of the sheet

16. (10 pts) A mass weighing 8 lbs is attached to a 5 ft spring and stretches the spring so that its new length is 9 ft. This mass is replaced by another mass which weighs 16 lbs. The medium through which the spring-mass system moves creates a damping force equal to the instantaneous velocity. The mass is released at a point ½ ft below the equilibrium position with an initial downward velocity of 3 ft/sec. Find the equation of motion.