Name ____________________ Class Time _____

Math 2250 Extra Credit Problems
Chapter 10
April 2007

Due date: The due date for these problems is the day after the last day of classes. Records are locked on that date and only corrected, never appended. The scores can replace *any* missing score for the entire semester.

Submitted work. Please submit one stapled package per problem. Kindly label problems **Extra Credit**. Label each problem with its corresponding problem number. You may attach this printed sheet to simplify your work.

Problem Ex10.3-20. (Inverse transform)

Solve for $f(t)$ in the relation $\mathcal{L}(f(t)) = \dfrac{1}{s^4 - 8s^2 + 16}$. Use partial fractions in the details.

Problem Ex10.3-24. (Inverse transform)

Solve for $f(t)$ in the relation $\mathcal{L}(f(t)) = \dfrac{s}{s^4 + 4a^4}$, showing the details that give the answer $f(t) = \dfrac{1}{2a^2}\sinh at \sin at$

Problem Ex10.4-12. (Inverse transform, convolution)

Solve for $f(t))$ in the relation $\mathcal{L}(f(t)) = \dfrac{1}{s(s^2 + 4s + 5)}$. Instead of the convolution theorem, use partial fractions for the details. If you can see how, then check the answer with the convolution theorem.

Problem Ex10.4-26. (Inverse transform techniques)

Use the s-differentiation theorem in the details of solving for $f(t)$ in the relation $\mathcal{L}(f(t)) = \arctan \dfrac{3}{s+2}$. You will need to apply the theorem $\lim_{s\to\infty} \mathcal{L}(f(t)) = 0$.

Problem Ex10.4-40. (Series methods for transforms)

Expand in a series, using Taylor series formulas, the function $f(t) = \dfrac{\cos 2\sqrt{t}}{\sqrt{\pi t}}$. Then find $\mathcal{L}(f(t))$ as a series by Laplace transform of each series term, separately. Finally, re-constitute the series in variable s into elementary functions, namely $e^{-1/s}$ divided by $\sqrt{s}$.

Problem Ex10.5-6. (Second shifting theorem, Heaviside step)

Find the function $f(t)$ in the relation $\mathcal{L}(f(t)) = \dfrac{se^{-s}}{s^2 + \pi^2}$.

Problem Ex10.5-14. (Transforms of piecewise functions)

Let $f(t) = \begin{cases} \cos \pi t & 0 \le t \le 2, \\ 0 & t > 2. \end{cases}$ Find $\mathcal{L}(f(t))$. Details should expand $f(t)$ as a linear combination of Heaviside step functions.

Problem Ex10.5-26. (Sawtooth wave)

Let $f(t + a) = f(t)$ and $f(t) = t$ on $0 \le t \le a$. Then f is a-periodic and has a Laplace transform obtained from the periodic function formula. Show the details in the derivation to obtain the answer $\mathcal{L}(f(t)) = \dfrac{1}{as^2} - \dfrac{e^{-as}}{s(1 - e^{-as})}$.

Problem Ex10.5-28. (Modified sawtooth wave)

Let $f(t + 2a) = f(t)$ and $f(t) = t$ on $0 \le t \le a$, $f(t) = 0$ on $a < t \le 2a$. Then f is $2a$-periodic and has a Laplace transform obtained from the periodic function formula. Derive a formula for $\mathcal{L}(f(t))$.

End of extra credit problems chapter 10.