Submitted work. Please submit one stapled package with this sheet on top. Kindly check-mark the problems submitted and label the paper [Extra Credit]. Label each solved problem with its corresponding problem number, e.g., [Xc10.3-20].

Problem Xc10.3-20. (Inverse transform)
Solve for $f(t)$ in the relation $L(f(t)) = \frac{1}{s^4 - 8s^2 + 16}$. Use partial fractions in the details.

Problem Xc10.3-24. (Inverse transform)
Solve for $f(t)$ in the relation $L(f(t)) = \frac{s}{s^4 + 4a^4}$, showing the details that give the answer $f(t) = \frac{1}{2a^2} \sinh at \sin at$.

Problem Xc10.4-12. (Inverse transform, convolution)
Solve for $f(t)$ in the relation $L(f(t)) = \frac{1}{s(s^2 + 4s + 5)}$. 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 Xc10.4-26. (Inverse transform techniques)
Use the $s$-differentiation theorem in the details of solving for $f(t)$ in the relation $L(f(t)) = \arctan \frac{3}{s + 2}$. You will need to apply the theorem $\lim_{s \to \infty} L(f(t)) = 0$.

Problem Xc10.4-40. (Series methods for transforms)
Expand in a series, using Taylor series formulas, the function $f(t) = \frac{\cos \sqrt{t}}{\sqrt{\pi t}}$. Then find $L(f(t))$ 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 Xc10.5-6. (Second shifting theorem, Heaviside step)
Find the function $f(t)$ in the relation $L(f(t)) = \frac{se^{-s}}{s^2 + \pi^2}$.

Problem Xc10.5-14. (Transforms of piecewise functions)
Let $f(t) = \begin{cases} \cos \pi t & 0 \leq t \leq 2, \\ 0 & t > 2. \end{cases}$ Find $L(f(t))$. Details should expand $f(t)$ as a linear combination of Heaviside step functions.

Problem Xc10.5-26. (Sawtooth wave)
Let $f(t + a) = f(t)$ and $f(t) = t$ on $0 \leq t \leq a$. 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 $L(f(t)) = \frac{1}{as^2} - \frac{e^{-as}}{s(1 - e^{-as})}$.

Problem Xc10.5-28. (Modified sawtooth wave)
Let $f(t + 2a) = f(t)$ and $f(t) = t$ on $0 \leq t \leq a$, $f(t) = 0$ on $a < t \leq 2a$. Then $f$ is $2a$-periodic and has a Laplace transform obtained from the periodic function formula. Derive a formula for $L(f(t))$. The answer to this problem can be found in Edwards-Penney, section 10.5.

Problem Xc-EPbvp-7.6-8. (Impulsive DE)
Solve by Laplace methods $x'' + 2x' + x = \delta(t) - 2\delta(t-1)$, $x(0) = 1$, $x'(0) = 1$. Check the answer in maple using 
\texttt{dsolve}\{(\text{de}),x(t),\text{method=laplace}\}.

Problem Xc-EPbvp-7.6-18. (Switching circuit)
A passive LC-circuit has battery 6 volts and model equation $i'' + 100i = 6\delta(t) - 6\delta(t-1)$, $i(0) = 1$, $i'(0) = 1$. The switch is closed at time $t = 0$ and opened again at $t = 1$. Solve the equation by Laplace methods and report the number of full cycles observed before the steady-state $i = 0$ is reached (to two decimal places). Check the answer in maple using 
\texttt{dsolve}\{(\text{de},\text{ic}),i(t),\text{method=laplace}\}.

End of extra credit problems chapter 10.