ENEE 322

Sections 0201 & 0202 | Spring 2018

Homework #12

This homework is worth 50% of other homeworks.

1) For each of the following signals, **using the definition of the Laplace transform**, compute the Laplace transform, its region of convergence (ROC), the zeros and poles. Sketch the ROC and the locations of zeros and poles.
   a) $x(t) = u(t - t_0)$
   b) $x(t) = \delta'(t)$
   c) $x(t) = u(t)\mathrm{e}^{-at}$ (separate sketches for $a > 0$ and $a < 0$)
   d) $x(t) = u(-t)\mathrm{e}^{-at}$ (separate sketches for $a > 0$ and $a < 0$)
   e) $x(t) = u(t)\cos(2\pi f_0 t)$
   f) $x(t) = u(-t)\cos(2\pi f_0 t)$
   g) $x(t) = \mathrm{e}^{-5t}\left(u(t+1) - u(t)\right)$

2) For each of the following signals, compute the Laplace transform, its region of convergence (ROC), and its zeros and poles. Sketch the ROC and the locations of zeros and poles. If the Laplace transform does not exist, (i.e. the ROC is the null set), point this out.
   a) $x(t) = u(t)\mathrm{e}^{-5t} + u(t)\mathrm{e}^{-2t}$
   b) $x(t) = u(t)\mathrm{e}^{-5t} - u(-t)\mathrm{e}^{-2t}$
   c) $x(t) = -u(-t)\mathrm{e}^{-5t} + u(t)\mathrm{e}^{-2t}$
   d) $x(t) = -u(-t)\mathrm{e}^{-5t} - u(-t)\mathrm{e}^{-2t}$

3) $X(s)$ has a single simple zero at $s = 0$, and two simple poles, at $s = 1$ and $s = 3$. Using the method of partial fractions, calculate $x(t)$ (up to overall scale) for
   a) ROC = $\{s : \mathrm{Re}(s) > 3\}$
   b) ROC = $\{s : \mathrm{Re}(s) < 1\}$
   c) ROC = $\{s : 1 < \mathrm{Re}(s) < 3\}$