Signals

- f(t) → F(s)
  - — Integral definition PS1
  - — Tables & properties PS2
    - linearity PS2: 1
    - time shift PS2: 2,3
- F(s) → f(t) by PFD
  - — real, unique poles PS3: 1,3
  - — real, repeated poles PS3: 2
  - — complex conjugate poles PS3: 5
  - — make improper fractions proper PS3: 4
- Initial and Final Value Theorem PS2: 4

Systems

- Given x(t) and h(t) find y(t) by convolution
  - — Integral definition PS4: 1
  - — Graphical flip-and-slide (limited to flat-topped functions) PS4: 3,4
- Given circuit schematic and x(t), find y(t) usingLT
  - — no initial conditions PS5: 1
  - — initial conditions PS5: 2
  - — opamps PS6: 2, PS7: 2
  - — dependent sources PS6: 1
- Convert between these representations
  - — circuit schematic PS5, PS6, PS7:1,2
  - — transfer function H(s) PS6, PS7
  - — differential equation PS8:1
  - — impulse response h(t) PS3, PS8:1
  - — s-plane representation (& BIBO stability, damping, oscil) PS8: 2

Notes

- One test problem for each of the above • bullet points. To shorten the test, some topics will be combined into a single problem. You can make excellent, if slightly long, sample test by choosing one homework problem from each bullet point. Not all subtopics (the — bullets) will be tested.
- The attached Laplace Transform table will be on the last page of the test.
- You may bring a
  - hand calculator
  - a 3x5 card, both sides, of your notes. No restrictions on content (may be outline, worked problems, photocopied text pages) as long as it is not copied from another student
  - clean FE handbook that you personally own

EE230 Laplace Transforms

Transform Pairs

	$f(t)$	$F(s)$
Unit impulse	$\delta(t)$	1
Unit step	$u(t)$	$\frac{1}{s}$
Unit ramp	$t\,u(t)$	$\frac{1}{s^2}$
n[th] integral of an impulse	$\int\cdots\int\delta(t)$	$\frac{1}{s^n}$
Power of t	$\frac{t^{n-1}}{(n-1)!}u(t)$	$\frac{1}{s^n}$
Derivative of an impulse	$\delta'(t)$	s
n[th] derivative of an impulse	$\delta^{(n)}(t)$	s^n
Exponential	$e^{-at}\,u(t)$	$\frac{1}{s+a}$
t times exponential	$te^{-at}\,u(t)$	$\frac{1}{(s+a)^2}$
t[n] times exponential	$\frac{1}{(n-1)!}t^{n-1}e^{-at}$	$\frac{1}{(s+a)^n}$
Sine	$\sin(\omega t)\,u(t)$	$\frac{\omega}{s^2+\omega^2}$
Cosine	$\cos(\omega t)\,u(t)$	$\frac{s}{s^2+\omega^2}$
Damped sine	$e^{-at}\sin(\omega t)\,u(t)$	$\frac{\omega}{(s+a)^2+\omega^2}$
Damped cosine	$e^{-at}\cos(\omega t)\,u(t)$	$\frac{s+a}{(s+a)^2+\omega^2}$

Transform Properties

	$f(t)$	$F(s)$
Linearity	$c_1 f_1(t)+c_2 f_2(t)$	$c_1F_1(s)+c_2F_2(s)$
Differentiation	$\frac{d}{dt}f(t)$	$sF(s)-f(0^-)$
Double differentiation	$\frac{d^2}{dt^2}f(t)$	$s^2F(s)-sf(0^-)-f'(0^-)$
Integration	$\int_{0-}^{t} f(\tau)d\tau$	$\frac{1}{s}F(s)$
Time shift	$f(t-t_0)u(t-t_0),\quad t_0>0$	$e^{-st_0}F(s)$
Convolution	$f_1(t)*f_2(t)$	$F_1(s)F_2(s)$
Initial value	$f(0)$	$\lim_{s\to\infty}sF(s)$
Final value	$f(\infty)$	$\lim_{s\to 0}sF(s)$