ESE 406 / ESE 505 / MEAM 513 Midterm Exam Cheat Sheet

Function	Time domain $f(t) = \mathcal{L}^{-1}\{F(s)\}$	Laplace s-domain $F(s) = \mathcal{L}\{f(t)\}$
nth power (for integer n)	$\frac{t^n}{n!} \cdot u(t)$	$\frac{1}{s^{n+1}}$
qth power (for complex q)	$\frac{t^q}{\Gamma(q+1)} \cdot u(t)$	$\frac{1}{s^{q+1}}$
unit step	$u(t)$	$\frac{1}{s}$
delayed unit step	$u(t-\tau)$	$\frac{e^{-\tau s}}{s}$
ramp	$t \cdot u(t)$	$\frac{1}{s^2}$
nth power with frequency shift	$\frac{t^n}{n!}e^{-\alpha t} \cdot u(t)$	$\frac{1}{(s+\alpha)^{n+1}}$
exponential decay	$e^{-\alpha t} \cdot u(t)$	$\frac{1}{s+\alpha}$
exponential approach	$(1-e^{-\alpha t}) \cdot u(t)$	$\frac{\alpha}{s(s+\alpha)}$
sine	$\sin(\omega t) \cdot u(t)$	$\frac{\omega}{s^2+\omega^2}$
cosine	$\cos(\omega t) \cdot u(t)$	$\frac{s}{s^2+\omega^2}$
hyperbolic sine	$\sinh(\alpha t) \cdot u(t)$	$\frac{\alpha}{s^2-\alpha^2}$
hyperbolic cosine	$\cosh(\alpha t) \cdot u(t)$	$\frac{s}{s^2-\alpha^2}$
Exponentially-decaying sine wave	$e^{-\alpha t}\sin(\omega t) \cdot u(t)$	$\frac{\omega}{(s+\alpha)^2+\omega^2}$
Exponentially-decaying cosine wave	$e^{-\alpha t}\cos(\omega t) \cdot u(t)$	$\frac{s+\alpha}{(s+\alpha)^2+\omega^2}$

NOTE: u(t) in table is unit step

$$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)\, dt.$$

$$t_r \approx \frac{2.0}{\omega_n} \qquad t_s \approx \frac{4.0}{\sigma}$$