Operation Transforms		
N	F(s)	f (t) , t > 0
1.1	$Y(s) = \int_0^{\infty} \exp(-st)y(t)dt$	Definition of a Laplace transform y(t)
1.2	Y(s)	inversion formula $y(t) = \frac{1}{j2\pi}\int_{c-j\infty}^{c+j\infty} \exp(st)Y(s)\,ds$
1.3	$sY(s) - y(0)$	first derivative $y'(t)$
1.4	$s^2 Y(s) - s\,y(0) - y'(0)$	second derivative $y''(t)$
1.5	$s^n Y(s) - s^{n-1}[y(0)] - s^{n-2}[y'(0)] - \cdots - s\left[y^{(n-2)}(0)\right] - \left[y^{(n-1)}(0)\right]$	nth derivative $y^{(n)}(t)$
1.6	$\frac{1}{s}F(s)$	integration $\int_0^t Y(\tau)d\tau$
1.7	F(s)G(s)	convolution integral $\int_0^t f(t-\tau)g(\tau)d\tau$
1.8	$\frac{1}{\alpha}F\left(\frac{s}{\alpha}\right)$	$f(\alpha t)$
1.9	$F(s-\alpha)$	shifting in the s-plane $\exp(\alpha t)\,f(t)$
1.10	$\frac{1}{1-\exp(-sT)}\int_0^T \exp(-st)f(t)dt$	f(t) has period T, such that f(t + T) = f (t)
1.11	$\frac{1}{1+\exp(-sT)}\int_0^T \exp(-st)g(t)\,dt$	g(t) has period T, such that g(t + T) = - g(t)

Function Transforms		
N	F(s)	f (t) , t > 0
2.1	1	$\delta(t)$, unit impulse at t = 0
2.2	s	$\frac{d}{dt}\delta(t)$, double impulse at t = 0
2.3	$\exp(-\alpha s), \ \alpha \geq 0$	$\delta(t-\alpha)$
2.4a	$\frac{1}{s}$	unit step u(t)
2.4b	$\frac{1}{s}\left[\exp(-as)-\exp(-bs)\right]$	0 $t < a$ 1 $a < t < b$ 0 $t > b$
2.5	$\frac{1}{s}\exp(-\alpha s)$	$u(t-\alpha)$
2.6	$\frac{1}{s^2}$	t
2.7a	$\frac{1}{s^n}, \quad n = 1, 2, 3, \ldots$	$\frac{t^{n-1}}{(n-1)!}$
2.7b	$\frac{n!}{s^{n+1}}$, n=1, 2, 3,….	t^n
2.8	$\frac{1}{s^k}$, k is any real number > 0	$\frac{t^{k-1}}{\Gamma(k)}$ the Gamma function is given in Appendix A
2.9	$\frac{1}{s+\alpha}$	$\exp(-\alpha t)$
2.10	$\frac{1}{(s+\alpha)^2}$	$t\exp(-\alpha t)$

2.11	$\frac{1}{(s+\alpha)^n}$, n=1, 2, 3,….	$\left[\frac{t^{n-1}}{(n-1)!}\right]\exp(-\alpha t)$
2.12	$\frac{\alpha}{s(s+\alpha)}$	$1-\exp(-\alpha t)$
2.13	$\frac{1}{(s+\alpha)(s+\beta)}, \quad \beta \neq \alpha$	$\frac{1}{(\beta-\alpha)}[\exp(-\alpha t)-\exp(-\beta t)]$
2.14	$\frac{1}{s(s+\alpha)(s+\beta)}, \quad \beta \neq \alpha$	$\frac{1}{\alpha\beta}+\frac{\exp(-\alpha t)}{\alpha(\alpha-\beta)}+\frac{\exp(-\beta t)}{\beta(\beta-\alpha)}$
2.15	$\frac{s}{(s+\alpha)(s+\beta)}, \quad \beta \neq \alpha$	$\frac{1}{(\alpha-\beta)}[\alpha\exp(-\alpha t)-\beta\exp(-\beta t)]$
2.16a	$\frac{\alpha}{s^2+\alpha^2}$	$\sin(\alpha t)$
2.16b	$\frac{[\sin(\phi)]s+\alpha[\cos(\phi)]}{s^2+\alpha^2}$	$\sin(\alpha t+\phi)$
2.17	$\frac{s}{s^2+\alpha^2}$	$\cos(\alpha t)$
2.18	$\frac{s^2-\alpha^2}{\left[s^2+\alpha^2\right]^2}$	$t\cos(\alpha t)$
2.19	$\frac{1}{s\left(s^2+\alpha^2\right)}$	$\frac{1}{\alpha^2}[1-\cos(\alpha t)]$
2.20	$\frac{1}{\left(s^2+\alpha^2\right)^2}$	$\frac{1}{2\alpha^3}[\sin(\alpha t)-\alpha t\cos(\alpha t)]$
2.21	$\frac{s}{\left(s^2+\alpha^2\right)^2}$	$\frac{1}{2\alpha}[t\sin(\alpha t)]$
2.22	$\frac{s^2}{\left(s^2+\alpha^2\right)^2}$	$\frac{1}{2\alpha}[\sin(\alpha t)+\alpha t\cos(\alpha t)]$
2.23	$\frac{1}{\left(s^2+\omega^2\right)\left(s^2+\alpha^2\right)}, \quad \alpha \neq \omega$	$\left\{\frac{1}{\omega^2-\alpha^2}\right\}\left\{\frac{1}{\alpha}\sin(\alpha t)-\frac{1}{\omega}\sin(\omega t)\right\}$

2.24	$\dfrac{\alpha}{s^2(s+\alpha)}$	$t - \dfrac{1}{\alpha}\left[1 - \exp(-\alpha t)\right]$
2.25	$\dfrac{\beta}{(s+\alpha)^2 + \beta^2}$	$\exp(-\alpha t)\sin(\beta t)$
2.26	$\dfrac{s+\alpha}{(s+\alpha)^2 + \beta^2}$	$\exp(-\alpha t)\cos(\beta t)$
2.27	$\dfrac{s+\lambda}{(s+\alpha)^2 + \beta^2}$	$\exp(-\alpha t)\left\{\cos(\beta t) + \left[\dfrac{\lambda - \alpha}{\beta}\right]\sin(\beta t)\right\}$
2.28	$\dfrac{s+\alpha}{s^2 + \beta^2}$	$\dfrac{\sqrt{\alpha^2 + \beta^2}}{\beta}\sin(\beta t + \phi), \quad \phi = \arctan\left(\dfrac{\beta}{\alpha}\right)$
2.29	$\dfrac{1}{s^2 - \alpha^2}$	$\dfrac{1}{\alpha}\sinh(\alpha t)$
2.30	$\dfrac{s}{s^2 - \alpha^2}$	$\cosh(\alpha t)$
2.31	$\arctan\left(\dfrac{\alpha}{s}\right)$	$\dfrac{1}{t}\sin(\alpha t)$