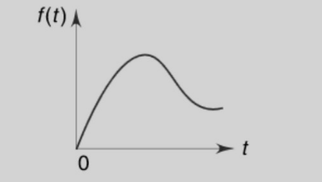
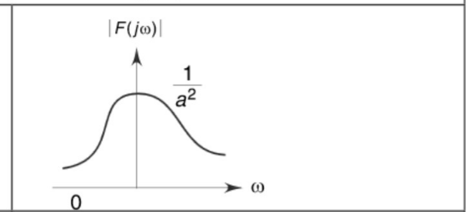
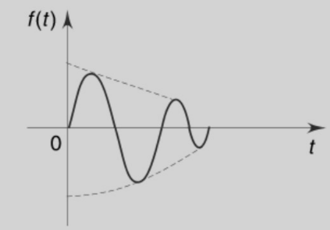
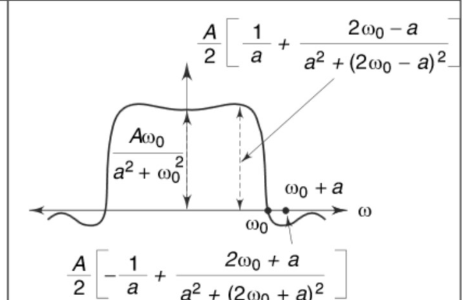
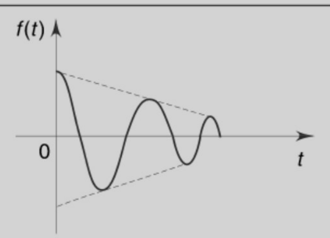
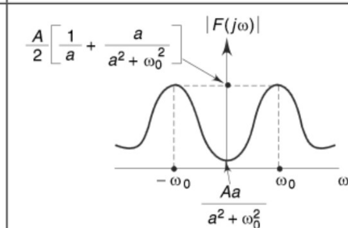
Sl.No	Time domain $f(t)$		Frequency domain $F(j\omega)$	
17.		$t \exp(-at)u(t)$	$\frac{1}{(a+j\omega)^2}$	
18.		$\frac{t^{n-1}}{(n-1)!}\exp(-at)u(t)$	$\frac{1}{(a+j\omega)^n}$	
19.		$A\exp(-at)\sin(\omega_0 t)u(t)$	$\frac{A\omega_0}{(a+j\omega)^2+\omega_0^2}$	
20.		$A\exp(-at)\cos(\omega_0 t)u(t)$	$A\frac{a+j\omega}{(a+j\omega)^2+\omega_0^2}$	
21.		$\cos\omega_0 t\,[u(t+T)-u(t-T)]$	$T\left[\frac{\sin(\omega-\omega_0)T}{(\omega-\omega_0)T}+\frac{\sin(\omega+\omega_0)T}{(\omega+\omega_0)T}\right]$	

The Fourier transform of $f(t)$ is

$$F(j\omega) = \mathcal{F}[f(t)] = \int_{-\infty}^{\infty} f(t)e^{-j\omega t}\,\mathrm{d}t$$

$$= \int_{-T/2}^{T/2} 1 \cdot e^{-j\omega t}\,dt = \frac{1}{-j\omega}[e^{-j\omega t}]_{-T/2}^{T/2}$$

$$= \frac{1}{-j\omega}\left[e^{-j\omega T/2} - e^{-j\omega T/2}\right] = T \cdot \frac{\sin\left(\frac{\omega T}{2}\right)}{\left(\frac{\omega T}{2}\right)} = T\,\mathrm{sinc}\left(\frac{\omega T}{2}\right)$$

Hence, the amplitude spectrum is $|F(j\omega)| = T\left|\mathrm{sinc}\left(\frac{\omega T}{2}\right)\right|$

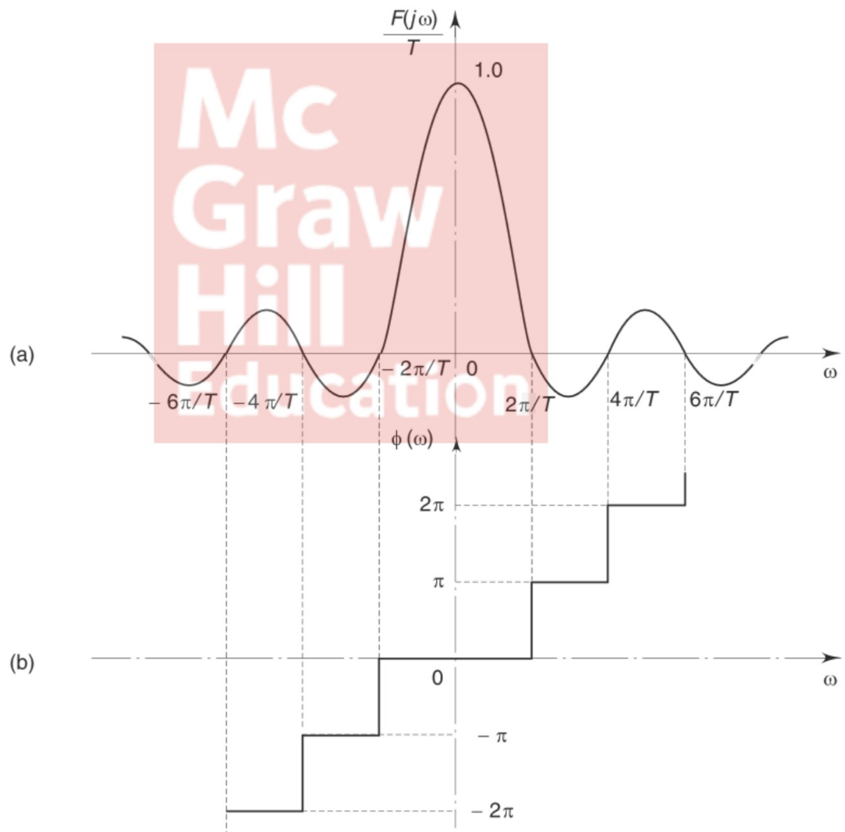


Fig. 2.5 (a) *Amplitude Spectrum and*
(b) *Phase Spectrum of the Single Gate Function*

and the phase spectrum is $\angle F(j\omega) = \begin{cases} 0, & \mathrm{sinc}\left(\frac{\omega T}{2}\right) > 0 \\ \pi & \mathrm{sinc}\left(\frac{\omega T}{2}\right) < 0 \end{cases}$