Stanford University
Department of Electrical Engineering
Qualifying Examination Winter 2008-09
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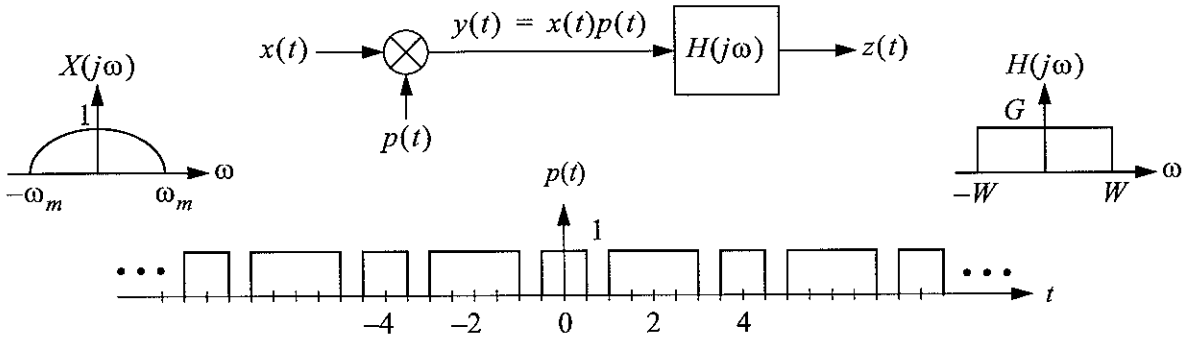
Consider the following system.



The signal $x(t)$ is bandlimited to $|\omega| \leq \omega_m$. It is multiplied by $p(t)$, the periodic signal shown. The product, $y(t)$, is passed through the ideal lowpass filter $H(j\omega)$, which has cutoff frequency W and gain G.

Since $p(t)$ is periodic with period T_0 and fundamental frequency $\omega_0 = 2\pi/T_0$, it can be represented as a Fourier series:

$$p(t) = \sum_{n=-\infty}^{\infty} P_n e^{jn\omega_0 t}.$$

- Without explicitly calculating the P_n, find an expression for $Y(j\omega)$, the Fourier transform of $y(t)$, in terms of $X(j\omega)$ and the P_n.

- State the conditions on ω_m, W and G such that $z(t) = x(t)$. Be as specific as possible, replacing variables by specific numbers when possible.