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EEEN 322 Spring 2019
QUIZ #2
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(Section 02)

Assume that we have a message signal $m(t) = 2\cos 2000\pi t$ and we would like to perform phase modulation with $f_c = 150$ MHz, $A = 3$, and $k_p = 600\pi$.

a) Write the mathematical expression of $\varphi_{PM}(t)$.

b) Find the power of $\varphi_{PM}(t)$.

c) Find the frequency deviation Δf.

d) Estimate the bandwidth B_{PM}.

e) Is this NBPM or WBPM? Why?

a) $\varphi_{PM}(t) = A\cos[\omega_c t + k_p m(t)]$

$\omega_c = 2\pi \times 150\times10^6 = 3\pi\times10^8$ rad/s

$\Rightarrow \varphi_{PM}(t) = 3\cos[3\pi\times10^8 t + 1200\pi\cos 2000\pi t]$ (20p)

b) $P = A^2/2 = 3^2/2 = 4.5$ (20p)

c) $\dot{m}(t) = -4000\pi \sin 2000\pi t \Rightarrow m_p' = 4000\pi$

$\Delta f = \frac{k_p m_p'}{2\pi} = \frac{(600\pi)(4000\pi)}{2\pi} = 1200000\pi \cong 3.77$ MHz (20p)

d) $B = \frac{2000\pi}{2\pi} = 1000$ Hz $= 1$ kHz

$B_{PM} = 2(\Delta f + B) = 2(3.77 + 0.001) \cong 7.54$ MHz (20p)

e) Since $\Delta f = 3.77$ MHz $>>$ $B = 1$ kHz, this is WBPM (20p)