

**Introduction to Communication Systems**  
**Columbia University**  
**ELEN E3701**  
**Spring Semester- 2008**

**Problem Set # 2**

**Problems Due: 12 February 2008**

**Problem #1**

**Show that amplitude modulation (AM) is really not a linear modulation. Use the definition of linearity to prove this point.**

**Problems # 2-6**

**The next five problems come from Chapter II of Haykin's Book-**

**Problems 2.3, 2.5b, 2.6, 2.9 and 2.10**

**Problem # 7**

**In class we discussed quadrature modulation and quadrature demodulation.**

**a. What would be the output of both branches of the quadrature demodulator, if the demodulator is not phase synchronized with the modulator, and we multiply by  $2 \cos (2\pi f_0 t + \theta)$  and  $2 \sin (2\pi f_0 t + \theta)$  instead of  $2 \cos (2\pi f_0 t)$  and  $2 \sin (2\pi f_0 t)$ ?**

**b. What are the outputs when  $\theta = \pi/2$ ? **Interesting result!!!****