ECECC13: Communication Engineering
Tutorial Sheet # 1

Q.1 Find the percentage modulation of an AM wave whose total power content is 2500 W and whose sidebands each contains 400W.

Q.2 An SSB transmission contains 10KW. This transmission is to be replaced by by a standard AM signal with the same power content. Determine the power content of the carrier and each of the sidebands when the percent modulation is 80%.

Q.3 Consider a message signal $m(t)$ conatining frequency components at 300 and 3000 Hz. This signal is used to make an AM signal with carrier frequency 1 MHz. The receiver has a frequency error of 100 Hz. Determine the frequency components of the AM receiver output. State your assumptions. Repeat for DSB-SC and SSB-SC.

Q.4 In a DSB-SC system, the message signal is

$$m(t) = 2\cos(400t) + 4\sin(500t + \frac{\pi}{3})$$

and the carrier is $c(t) = A\cos(8000\pi t)$.
(a) Find the time domain and frequency domain representation of the modulated signal and plot the spectrum of the modulated signal.
(b) Find the power content of the modulated signal.

Q.5 A SSB-SC signal is generated by modulating an 800 KHz carrir by the signal

$$m(t) = \cos(2000\pi t) + 2\sin(2000\pi t)$$

. The amplitude of the carrier is $A_c = 100$.
(a) Determinethe Hilbert transform of $m(t)$.
(b) Determine the time domain expression for the LSB of the SSB-SC signal.
(c) Determine the magnitude spectrum of the LSB-SSB signal.

Q.6 (a) Prove that the signal

$$s(t) = \sum_{i=1}^{N}[\cos(\omega_c t)\cos(\omega_i t + \phi_i) - \sin(\omega_c t)\sin(\omega_i t + \phi_i)]$$

is an SSB signal ($f_c \gg f_N$). Identify the side band.
(b) Obtain an expression for missing side band.
(c) Obtain an expression of the DSB-SC signal.