

EE 483 Communications Systems I  
Homework Set 4

1. (10/100) In a DSB system the carrier is  $c(t) = A \cos(2\pi f_c t)$  and the message signal is given by  $m(t) = (\text{sinc}(t) + \text{sinc}^2(t))$ . Find the frequency domain representation and the bandwidth of the modulated signal.

**Hint:** The Fourier transform of

$$\Lambda(t) = \begin{cases} t + 1, & -1 \leq t < 0 \\ -t + 1, & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

is  $\text{sinc}^2(f)$  and the Fourier transform of the rectangular pulse is  $\text{sinc}(f)$ .

2. (20/100, equally weighted parts) An AM signal has the form

$$u(t) = (20 + 2 \cos(3000\pi t) + 10 \cos(6000\pi t)) \cos(2\pi f_c t)$$

where  $f_c = 10^5$  Hz.

- a. Sketch the (voltage) spectrum of  $u(t)$ .
  - b. From the spectra determine the power of the sidebands.
3. (35/100) Exercise 2.12 from your Textbook.
4. (35/100) Weaver's SSB modulator is illustrated in the following figure. By taking the input signal as  $m(t) = \cos(2\pi f_m t)$ , where  $f_m < W$  demonstrate that by proper choice of  $f_1$  and  $f_2$  the output is a SSB signal.

