Prob 1 Given a message signal \( m(t) \) with a spectrum \( M(f) \) with bandwidth \( B=3\text{KHz} \).

1) Sketch a block diagram for a DSB transmitter at a frequency \( f_c=1.0\text{MHz} \). Given equation for \( g_{\text{DSB}} \) and sketch the output signal.
2) Sketch a block diagram for a DSB receiver to recover the message and give the frequency response. If filters are needed, assume ideal filters will be applied.
3) Repeat 1) for SSB transmitter;
4) Repeat 2) for SSB receiver;

Prob 2 Given the following circuit.

\[ g_1(t) = 2\cos(2\pi \times 10^3 t), \quad g_2(t) = 2\cos(4\pi \times 10^3 t), \]
\[ g_3(t) = 2\cos(2\pi \times 10^6 t), \quad g_4(t) = 2\cos(2\pi \times 1.5 \times 10^6 t), \]

1) Write the equation for \( y(t) \);
2) Sketch the amplitude spectrum, \( |Y(f)| \). Be sure to label x & y axes so the spectrum amplitude and frequency can be determined.

Prob 3 1) Draw the block diagram for amplitude modulation. The transmitter works at \( f_c \) and produces 100 W average output power (include a power amplifier as the last block). Assume a 1-volt tone at 2K Hz produces 100% modulation.
2) What’s the peak voltage output of the transmitter;
3) What’s the minimum voltage output of the transmitter;
4) What’s the average carrier power;
5) What’s the upper side band power?
6) What’s the lower side band power?
7) What’s the power efficiency?