Question 1

Consider the block diagram of Fig. 1, where

1. $m(t)$ **is a lowpass message with the bandwidth** W**.**
2. **The output of the USSB modulator is** $u(t) = A_{c_{USSB}}\left[m(t)\cos(2\pi f_{c_{USSB}}t) - \hat{m}(t)\sin(2\pi f_{c_{USSB}}t)\right]$**.**
3. **The FM modulator has the index** β_f **and its output is** $v(t) = A_{c_{FM}}\cos(2\pi f_{c_{FM}}t + 2\pi k_f \int_{-\infty}^{t} u(\tau)d\tau)$**.**
4. **The USSD demodulator is an ideal coherent receiver.**
5. **The FM demodulator is an ideal FM receiver.**
6. **The required filters in the modulators and demodulators are ideal.**
7. $n_W(t)$ **is an AWGN noise with the power spectral density** $\frac{N_0}{2}$**.**

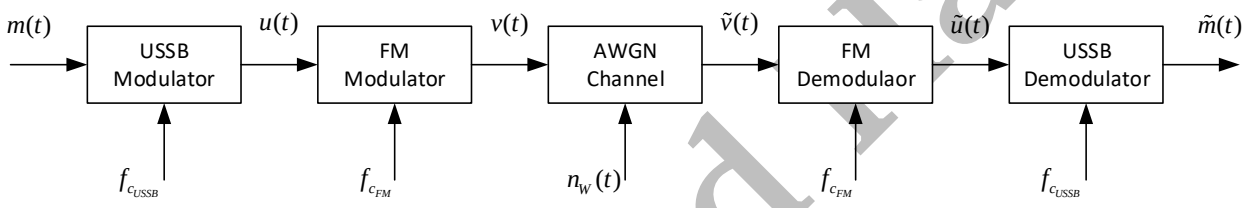

Figure 1: Cascade of USSB and FM modulations.

(a) Calculate the occupied bandwidth on the channel.

(b) Calculate the power transmitted to the channel.

(c) Assuming high SNR conditions, find the SNR of $\tilde{u}(t)$*.*

(d) Assuming high SNR conditions, find the SNR of $\tilde{m}(t)$*.*