EEE 317 Tutorial questions – AM/FM modulation & Digital vs. Analogue

(1) State the signal to noise ratio in an FM system.

(2) Sketch the filter characteristic of a pre-emphasis filter

(3) For the same signal amplitude, which of DSB SC and DSB LC gives a superior signal to noise ratio at the demodulator output and why?

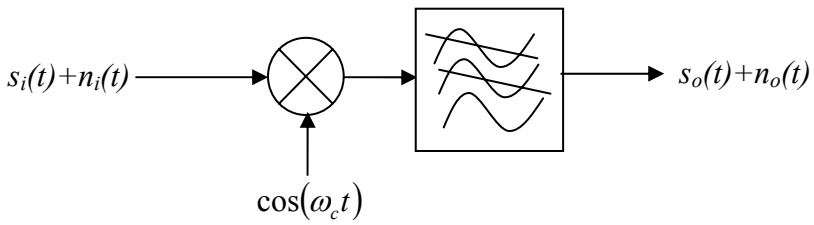
(4) Calculate the signal to noise ratio for an FM system with $\alpha = 0.1$V, $\Delta\omega =$ 75kHz, $\eta = 1\mu$W/Hz and $\beta = 5$.

(5) Explain why pre-emphasis and de-emphasis systems are commonly used in FM transmitters.

(6) A single sideband suppressed carrier SSB-SC AM signal has the following form,

$$s_i(t) = g(t)\cos(\omega_c t) + \hat{g}(t)\sin(\omega_c t),$$

where *g(t)* is the message waveform, $\hat{g}(t)$ is the message waveform phase-shifted by 90° and ω_c is the carrier frequency. This signal is demodulated using the circuit shown below. The low pass filter has a cut-off frequency just higher than the maximum frequency contained in *g(t)*.



Show that the input signal to noise power ratio is equal to the output power signal to noise ratio. You should assume that $n_i(t) = n_c(t)\cos(\omega_c t) - n_s(t)\sin(\omega_c t)$, $\overline{g(t)^2} = \overline{\hat{g}(t)^2}$ and that the noise power is dissipated into a 1Ω resistor.

7) Explain what is meant by bit stuffing.

8) Sketch the signal and noise powers of an analogue transmission as a function of distance, including a few repeating stations. How does this compare to a binary signal?