

ELECTRICAL COMMUNICATION SYSTEMS

ECE 09433

Homework 3

Please write your name, your class session, and your lecturer's name on your solutions. Numbers are from the textbook.

Problem 1 Textbook number 5-27

A sinusoidal signal $m(t) = \cos 2\pi f_m t$ is the input to an angle-modulated transmitter, $A_c=1$, and the carrier frequency is $f_c = 1$ Hz and $f_m = f_c/4$.

- (a) Plot $m(t)$ and the corresponding PM signal $S_p(t)$ using Matlab, where $D_p = \pi$.
- (b) Plot $m(t)$ and the corresponding FM signal $S_f(t)$ using Matlab, where $D_f = \pi$.

Problem 2 Textbook number 5-29

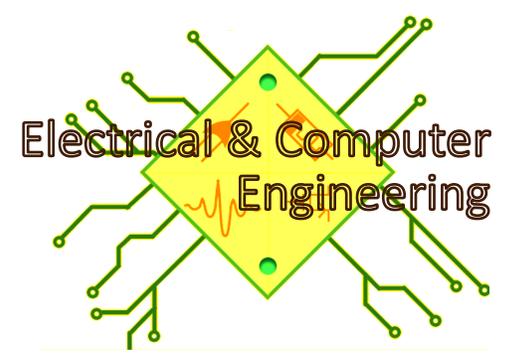
An FM signal has sinusoidal modulation with a frequency of $f_m=15$ kHz and modulation index of $\beta = 2.0$.

- (a) Find the transmission bandwidth by using Carson's rule.
- (b) What percentage of the total FM signal power lies within the Carson rule bandwidth?

Problem 3 Textbook number 5-32

A modulated RF waveform is given by $500\cos[\omega_c t + 20\cos \omega_1 t]$, where $\omega_1 = 2\pi f_1$, $f_1 = 1$ kHz, and $\omega_c = 2\pi f_c$, $f_c = 100$ MHz.

- (a) If the phase sensitivity D_p is 100 rad/V, find the mathematical expression for the corresponding phase modulation voltage $m(t)$. What is its peak value and its frequency?
- (b) If the frequency deviation constant D_f is 1×10^6 rad/V-s, find the mathematical expression for the corresponding FM voltage $m(t)$. What is its peak value and its frequency?



(c) If the RF waveform appears across a $50\text{-}\Omega$ load, determine the average power and the PEP.