

Homework 4

Submission Deadline: March 31, 2017 11:59 PM

Instructions:

- i) **Submit on Blackboard before the mentioned deadline.**
- ii) **No collaboration is allowed for any problems.**
- iii) **The points allotted for each problem is noted alongside.**
- iv) **You can use any software to draw the graphs.**
- v) **For MATLAB problems, submit both code as well as required figure on Blackboard.**

1. Chapter 12 Problem 10 (15points)

HINT:

Here $y_r(t)$ is a DSB-SC signal and $y_d(t)$ is the demodulated signal.

Plot the frequency domain representation of $y_d(t)$ to get $y_f(t)$ and calculate the signal power.

2. Consider a message signal $x(t) = 3\text{sinc}^2(4t)$.

This message signal is used to modulated carrier signal

$c(t) = 3\cos(800 \times 10^3 \pi t)$ to form a DSB-TC signal.

Find and plot the modulated DSB-TC signal in both frequency and time domain. (15 points)

3. Consider a message signal $x(t) = 2\cos(3000\pi t)$
is modulating a carrier signal $c(t) = \cos(3 \times 10^6 \pi t)$ using

i) Phase Modulation, $k_p = 0.001 \text{ radian/Volt}$

ii) Frequency Modulation, $k_f = 2\pi \times 10^5 \text{ Hz/Volt}$

In both cases, find and plot the modulated output signal in both time and frequency domain. (20 points)

MATLAB Problem

4. Using MATLAB, find the DSB-SC, DSB-TC and FM signals for carrier signal $c(t) = \cos(2 \times 10^6 \pi t)$ for message signal $x(t)$ which is periodic with period 4 and defined over a period as,

$$x(t) = \begin{cases} 0, & 0 < t \leq 10\mu s \\ 1, & 10\mu s < t \leq 20\mu s \\ 2, & 20\mu s < t \leq 30\mu s \\ 3, & 30\mu s < t \leq 40\mu s \end{cases}$$

Choose for FM $k_f = 2\pi \times 10^5 \text{ Hz/Volt}$, and for DSB-TC $m = 0.5, K=1$.

Plot the time domain and frequency domain plots for

- i) Message signal
- ii) DSB-SC
- iii) DSB-TC
- iv) FM

Plot the time domain plots for 4 periods i.e. $160 \mu s$.

Use MATLAB's fft function to find the frequency plot.

Submit relevant codes and plots. (10+10+15+15 points)