Lab – 4

Subject Code: EC303 P

Due Date:11/09/2020

Instructions:

1. Please mention legends, axis labels, titles etc in your plot/subplot for better understanding & clarity.
2. The report to be submitted must include matlab code & all observations pertaining to each plot below the same.
3. Kindly number your answers correctly.
4. **NO PLAGIARISM.**
5. Ask any questions in class or via LMS so that it will be beneficial to all (us and you).

Questions:

1. Modulation & demodulation of Double sideband with suppressed carrier (DSB-SC) signal using MATLAB
    a) Generate and plot the sinusoidal waveform $S_1(t)$ with amplitude of 0.5V and frequency of 200 Hz for two complete cycles.
    b) Generate and plot the sinusoidal waveform $S_2(t)$ with amplitude of 1V and frequency of 2000 Hz for the same time duration as $S_1(t)$.
    c) Using $S_1(t)$ as the message signal and $S_2(t)$ as the carrier signal, generate and plot the DSB-SC signal, $S_{31}(t)$.
    d) Plot the power spectrum of the DSB-SC signal, $S_{31}(t)$.
    e) Using (d), find the lower sideband and upper sideband power of the modulated signal, $S_{31}(t)$.
    f) Find the bandwidth and total power of the modulated signal, $S_{31}(t)$. Display all these values. Also compare these values obtained from simulation with theoretical values based on formulas.
    g) Demodulate the DSB-SC signal, $S_{31}(t)$ and plot it.
    h) Consider transmission of modulated DSB-SC signal, $S_{31}(t)$ over a noisy channel with AWGN noise and then demodulate it assuming SNR=5dB. Plot and compare the demodulated signal with message signal, $S_1(t)$.
    i) Consider transmission of modulated DSB-SC signal, $S_{31}(t)$ over a noisy channel with AWGN noise and then demodulate it assuming SNR=15dB. Plot and compare the demodulated signal with message signal, $S_1(t)$. Write your observation with respect to this increase in SNR.

2. Modulation & demodulation of Amplitude Modulated signal (Double sideband with carrier) using MATLAB
    a) Using $S_1(t)$ as the message signal and $S_2(t)$ as the carrier signal, generate and plot the amplitude modulated signal, $S_3(t)$.
    b) Plot the amplitude and power spectrum of the amplitude modulated signal, $S_3(t)$.

c) Using (b), find the carrier power, the lower sideband and upper sideband power of the modulated signal, $S_3(t)$.
d) Find the modulation index, bandwidth and total power of the modulated signal, $S_3(t)$. Compare these values obtained from simulation with theoretical values based on formulas.
e) Demodulate the amplitude modulated signal, $S_3(t)$ and plot it.
f) Plot the graph between the total AM power normalized to carrier power and modulation index. Consider modulation index varying from 0 to 1.5.

3. Modulation & demodulation of Single sideband with suppressed carrier (SSB-SC) signal using MATLAB
    a) Using $S_1(t)$ as the message signal and $S_2(t)$ as the carrier signal, generate and plot the SSB-SC signal, $S_{32}(t)$.
    b) Plot the power spectrum of the SSB-SC signal, $S_{32}(t)$.
    c) Using (b), find the sideband power of the modulated signal, $S_{32}(t)$.
    d) Calculate the bandwidth and total power of the modulated signal, $S_{32}(t)$. Display all these values calculated above.
    e) Demodulate the SSB-SC signal, $S_{32}(t)$ and plot it.
    f) Consider transmission of modulated SSB-SC signal, $S_{32}(t)$ over a noisy channel with AWGN noise and then demodulate it assuming SNR=15dB. Plot and compare the demodulated signal with message signal, $S_1(t)$.