EEE 302 - Midterm

03.05.2023

(18.00-20.00)

Question 1:

a) What is communication?

b) Why do we need modulation?

c) What is modulation?

d) What are the main differences between the conventional AM modulation and the DSB-SC modulation? Write their advantages and disadvantages.

Question 2:

a) Determine the Fourier Transform of the following signal and decide if it's an energy signal or a power signal.

$$x(t) = \Pi(t-2) + \Pi(t+2)$$

b) Determine the Fourier Transform of the following signal and show if it's an energy signal or a power signal.

$$x(t) = \frac{2}{1+t^2}$$

Question 3:

Let $m(t) = \text{sinc}^2(t)$ and

Let $x(t) = m(t)\cos 2\pi f_0 t + \hat{m}(t)\sin 2\pi f_0 t$ represent a bandpass signal and $\hat{m}(t)$ is the Hilbert Transform of $m(t)$.

a) Find the pre envelope and the complex envelope of $x(t)$.

b) Determine and plot the Fourier Transform of the signal $x(t)$. What is the bandwidth of $x(t)$?

Question 4:

The modulating signal $m(t) = 2\cos 4000\pi t + 5\cos 6000\pi t$ is multiplied by the carrier $c(t) = 50\cos 2\pi f_c t$ where $f_c = 40$ kHz.

a) Determine and sketch the spectrum of the DSB-SC signal.

b) Determine the average power in the frequency components.