

ECE 642 - Assignment 4

Please provide all details of your calculations. Responses with no details will not be considered. When plotting, please label all the axes with specific numerical values and units of measure.

1. (3 points) Plot (by hand) the absolute value and phase of the Fourier transform of

$$y(t) = \text{sinc}(t - 0.5) \sin(20\pi t).$$

2. (4 points) Consider the digital information messages $M_1 = (0, 0, 1, 1, 0)$ and $M_2 = (1, 1, 0, 1, 0)$. Assume that the transmission time of each bit is 1 second and that the carrier frequency is 1 Hz.

a. Assuming that message M_1 is used to modulate the amplitude of the carrier, plot (by hand) the passband signal $x_c(t)$ and the complex baseband equivalent $x_z(t)$.

b. Assuming that message M_1 is used to modulate the phase of the carrier, plot (by hand) the passband signal $x_c(t)$ and the complex baseband equivalent $x_z(t)$.

c. Assuming that message M_1 is used to modulate the phase of the carrier and M_2 modulates the amplitude, plot (by hand) the passband signal $x_c(t)$ and the complex baseband equivalent $x_z(t)$.

d. For the same conditions at point c., plot (by hand) $x_I(t)$ and $x_Q(t)$.

3. (3 points) Given the signal $\cos(4\pi t)\cos(20\pi t)^2$, determine the impulse response of a filter that outputs a signal proportional to $\cos(4\pi t)$. Can such a filter be found for the signal $\cos(4\pi t)\cos(20\pi t)\sin(20\pi t)$?