Objective

This lab explores the role of the roll-off factor in raised cosine pulse shaping. You will examine the signal in both time and frequency domains, compute theoretical and empirical bandwidths, and interpret the eye diagram to assess signal clarity.

MATLAB Setup

Run the provided script `Week10_Spring2025_RaisedCosine_Filter.m`. It will generate:

- A time-domain waveform for the first 10 symbols.
- Power spectral density (PSD) plots with 99% bandwidth annotation.
- Eye diagrams for the roll-off factor $\beta = 0.5$.

Assignment Tasks

Question 1 Time Domain Analysis (20 pts)

- Compare the waveform for the first 10 symbols across different β values.
- How does increasing β affect pulse width and overlap?
- Support your discussion with a figure and observations from the plot.

Question 2 Frequency Domain and Bandwidth (20 pts)

- Record the empirical 99% bandwidth for each β.
- Compute the theoretical bandwidth using:

$$BW_{th} = \frac{1+\beta}{2T}$$

- Fill in the table below:

β	99% Empirical BW (Hz)	Theoretical BW (Hz)
0.1		
0.5		
1.0		

- Comment on the agreement between theoretical and empirical results.

Question 3 Eye Diagram Interpretation (20 pts)

- Observe and compare the eye diagrams for each β.
- Which diagram has the most open eye? Explain the significance.
- How does β influence intersymbol interference and detectability?