Assignment to be submitted on Thursday 24th 2024

1. A communication system operates at a frequency of 100 MHz. Assuming the antenna is designed to be a quarter-wavelength antenna, calculate the required height of the antenna.
2. A carrier signal with a frequency of 1 MHz and an amplitude of 10 V is amplitude-modulated by a signal with a frequency of 10 kHz and a maximum amplitude of 5 V.
    a. Calculate the modulation index (m) for this system.
    b. Find the bandwidth of the AM signal.
    c. What are the frequencies of the sidebands generated in the AM process?
3. The international calling and distress frequency is 500 kHz. What is the equivalent wavelength and wave number?
4. Design a practical telegraph circuit and explain its working principle
5. Write a python code to represent graphically the signals on the same graphs

$$y_1 = 2\sin(100\,x) \qquad and \qquad y_2 = 4\sin(100\,x + \pi)$$

6. How can you plot a carrier signal, modulating signal, and the resulting Amplitude Modulated (AM) signal on the same graph using Matplotlib? What key parameters (like frequency and amplitude) would you need to adjust for each signal?
7. How can you generate and plot a Frequency Modulated (FM) signal in Python using numpy and matplotlib, and how does the plot change as you vary the frequency deviation or modulation index?