Objective
Verify Fourier series analysis results by comparison to both simulated and measured results.

Procedure
Consider the following circuit:

\[
\begin{align*}
&v_s(t) + \quad 10 \, \text{k}\Omega \
&\quad 0.1 \, \mu\text{F} \quad + \
&v_o(t) - \\
&\quad \text{Figure L7-1: Laboratory Circuit}
\end{align*}
\]

where \( v_s(t) \) is shown in Figure L7-2.

Procedure
1. Construct the circuit shown in Figure L7-1. While monitoring the input voltage on Channel 1 of the oscilloscope adjust the function generator until it produces a voltage like that shown in Figure L7-2. (The scope channel should be configured to use DC coupling so that the DC offset can be set correctly.) With Channel 1 measuring the input voltage and Channel 2 measuring the output voltage, adjust the scope settings so that the displayed input voltage matches the graph above as closely as possible. Use similar settings for the output channel, but adjust the vertical offset so that the input is displayed on the upper half of the scope display while the output is displayed in the lower half. Do a screen capture of the scope display so that it can be included in your report.

2. Use LTspice to simulate the circuit above for the input voltage shown in Figure L7-2. Plot the input voltage and output voltage in separate plot panes (with the output below the input). Scale the plot axes to match those in Figure L7-2. (You can set the initial capacitor voltage to 1.9 V to eliminate the transient component of the response.) Include this figure in your report.

3. Derive the frequency response \( H(\omega) \) for the circuit above. Use MATLAB/Octave and the `fs_trig2` function to graph four cycles (0 – 5 ms) of both the input and output using the first 500 harmonic components. Show these graphs in separate subplots in the same figure window with the output displayed below the input. Include these plots in your report. A script (`lab07.m`) is provided to plot the Fourier series approximation of the input. You will need to modify the script to compute the Fourier series approximation of the output. The compact trigonometric Fourier series coefficients for \( v_s(t) \) are:

\[
a_0 = 2.5; \quad A_n = \begin{cases} 
10/n\pi & \text{n odd} \\
0 & \text{n even}
\end{cases} \quad \theta_n = -\frac{\pi}{2}
\]

Notes on the Lab Report
Your results section should include plots of both the input and output as produced by MATLAB/Octave, LTSpice and the Oscilloscope. The input/output graphs produced by all three should be similar.