

## EEO 352 Fall 2023 - Assignment 2 – RC Filters and Diodes

Please document each step with snapshots of the built circuit, plots, pictures and your observations. Please include this page.

1a) Using the LTspice simulator, design an RC filter with  $R=1k\Omega$  and  $C=4.7nF$  (15pts):

- a) simulate and plot the response to a 1V 10kHz sinusoidal signal
- b) simulate and plot the response to a 1V 100kHz sinusoidal signal and extract the phase shift
- c) simulate and plot the frequency response (Bode plot: magnitude and phase)
- d) extract the -3dB frequency and the corresponding phase shift

1b) Using the Analog Discovery 2 and the components, build and measure the RC filter at (1a) (35 pts):

- a) measure and plot the response to a 1V 10kHz sinusoidal signal
- b) measure and plot the response to a 1V 100kHz sinusoidal signal and the phase shift
- c) measure (network function) and plot the frequency response (magnitude and phase)
- d) extrapolate, from the measurement of the resistor and the -3dB frequency, the exact value of the total capacitance
- e) remove the capacitor and extrapolate, from the measurement of the resistor and the -3dB frequency, the value of the residual capacitance from the oscilloscope input

2a) Using the LTspice simulator (15pts):

- a) simulate and plot the diode 1N4148 current for a -1V to +1V diode voltage swing
- b) place the marker at the 20mA current, report the corresponding voltage and the dynamic resistance (derivative)

2b) Using the Analog Discovery 2 and the diode 1N4001 (35 pts):

- a) trace the diode current
  - use a  $100\Omega$  series resistor
  - use a +/- 4V 100Hz triangular waveform
- b) zoom to the 20mA current, report the diode voltage, extrapolate the dynamic resistance

Hint: search for "Semiconductor Curve Tracer with the Analog Discovery 2"