Lect 1,2,3: Sample Questions

Practice Problems – Set 1 (April 2, 2023)

1. How would you define (in words) an ideal current source? Sketch its I-V characteristics.

2. Out of the following devices, choose ALL the ones which are single-port devices
    a. Resistor
    b. Transformer
    c. Inductor
    d. Bipolar Junction Transistor
    e. Capacitor

3. A *pn* junction diode has the following parameters: $I_S = 10^{-15}$ A, $V_T = (kT/q) = 25$ mV. Determine the current I_D through the diode for the following diode voltages V_D : i) $V_D = 0.2$ V, ii) $V_D = 0.5$ V, iii) $V_D = 0.7$ V, iv) $V_D = 0.8$ V, and $V_D = -1$ V.

4. Sketch the I-V characteristics of a silicon pn junction diode. You may assume the diode to be similar to the one you used in EE Expt 2 of the MS101 lab ($I_S = 10^{-14}$ A, $V_T = (kT/q) = 25$ mV). Mark the salient points, i.e. the typical voltages and currents.

5. A few statements are given below. For each statement, specify whether it is TRUE or FALSE.

    a) The light emitted by an LED is inversely proportional to the current flowing through it.

    b) A Solar cell requires an external bias voltage for its operation.

    c) An optocoupler is a combination of an LED and a photodiode and is used for passing on signal from one end to another with electrical isolation between them.

6. Sketch the circuit diagram of a half-wave rectifier with a capacitive filter. Sketch also the typical V_{out} waveform. What will be the effect of decreasing the capacitor on the ripple voltage in V_{out}? Justify your answer.
7. What are line and load regulations applied to a DC power supply?
8. In experiment 2, which DC power supply - the bridge rectifier with a capacitor filter of 1000 μF or the 7805 IC regulator – had lower output resistance? Justify your answer.