Simulation Exercise

1. Write ngspice netlist to measure I/V characteristics of RED, YELLOW, BLUE GREEN, and WHITE LED and the diode 1N914.

2. Run the simulation and plot all the characteristics on the same plot. Call this **Plot 1**.

3. Now plot a graph of $\ln I_D$ v/s V_D for all the diodes. Call this **Plot 2**. The slope of the graph is given by
$$\frac{\ln I_{D2} - \ln I_{D1}}{V_{D2} - V_{D1}} = \frac{1}{\eta V_T} \tag{1}$$
Calculate the ideality factor η of each diode from the slope. Also calculate the saturation current I_S from the y-intercept.

4. Calculate the bandgap E_g for each LED using the emission wavelengths from the Figure showing emission intensity v/s wavelengh of various LEDs (refer the labsheet slide no. 4) and putting them in equation (1) from the supporting document. Assume that for silicon(1N914), $E_g = 1.1$ eV.

5. From **Plot 1**, choose a constant value of I_D, say 1 mA. For each diode, find out the value of V_D corresponding to $I_D = 1$ mA.

6. Now plot a graph of V_D v/s E_g for all the diodes. For the chosen value of I_D, you should get one point (V_D, E_g) on the graph for each diode and hence you can plot all five points (for the different diodes) on a single graph.

7. From the graph, try to find a relation between V_D and E_g. What is the expected correlation? Do you observe any variation? If yes, why?