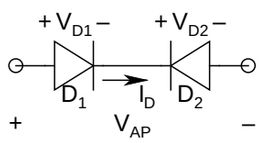
Department of Electrical Engineering
Indian Institute of Technology, Kanpur

EE 210 **Assignment #1** **Assigned: 13.1.21**

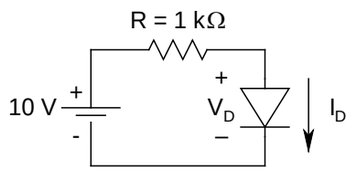
For all problems in this course, assume T = 300 K (with V_T = 26 mV), unless otherwise stated.

1. A pn junction diode has reverse saturation current I_0 = 10 pA. Determine the magnitude of the diode current (along with its direction) when it is under: i) forward bias of: a) 50 mV, and b) 500 mV; and ii) reverse bias of: a) 50 mV, and b) 500 mV.

2. Two diodes D_1 and D_2 are connected back to back with an applied bias of V_{AP} (= 5 V), as shown in the figure. Calculate the current I_D and the diode drops V_{D1} and V_{D2}. Data: $I_0(D_1)$ = 1 pA, and $I_0(D_2)$ = 1 nA.



3. A simple diode circuit is shown alongside. Perform a self-consistent analysis to find the diode current I_D and the diode voltage V_D. Take I_0 = 10 pA.



4. The measured junction capacitance C_{dep} (in μF) as a function of the applied voltage V_D (in volts) of an abrupt Si pn junction (area = 10 mm^2) is given by $1/C_{dep}^2$ = [$2.5 \times 10^5 \times (4 - 6.25V_D)$]. Determine the built-in voltage and the depletion region width at zero bias.

5. Consider Prob.3. Assuming that the junction is linearly graded, determine the small-signal parameters of the diode, and draw its small-signal equivalent circuit. Data: V_0 = 0.8 V, C_{dep0} = 1 pF, and τ = 1 μsec.