Department of ECE, Bennett University

EECE105L: Fundamentals of Electrical and Electronics Engineering

Tutorial Sheet-13

Topics Covered: Diode Circuits

If not mentioned, assume non-ideality factor (η) as 1.5, reverse saturation current I_0 as 5 nA.

1. A PN junction diode is in series with a 100 kΩ resistor and 3.5 V supply. If the diode is forward biased, determine the current through the diode and voltage across the diode. Given that the reverse saturation voltage is 5 nA and built-in voltage of diode is 0.6 V.
2. For the diode circuit shown in Fig. 1, V_S = 2 V. The silicon diode has a reverse saturation current of 1 nA at 300 K. Given that V = 0.7 V. Find

   i) R_2 when R_1 = 1 kΩ and ii) R_1 when R_2 = 1 kΩ

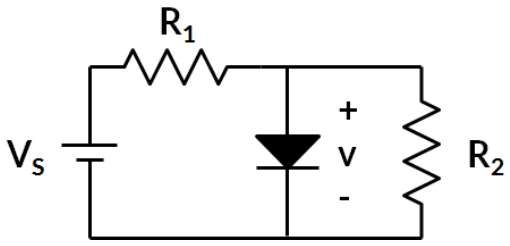

Fig. 1

3. For the diode circuit shown in Fig. 2, V_S = 6 V and have a reverse saturation current of 1 nA at 300 K. Answer the following questions:

   i) Find R_2 when R_1 = 10 kΩ and V_1 = 0.66 V

   ii) Find R_1 when R_2 = 100 Ω and V_2 = 0.66 V

   iii) Find R_1 and R_2 when V_1 = 0.68 V and V_2 = 0.66 V.

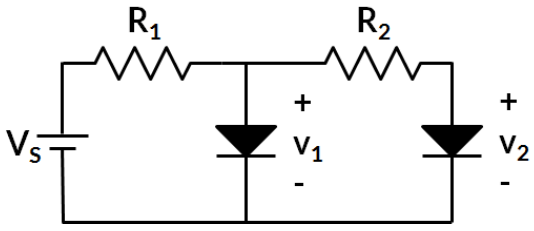

Fig. 2

4. For the diode circuit shown in Fig. 3 D_1 and D_2 are silicon diodes having saturation currents of 5 nA and 10 nA respectively, at 300 K. Given that both the diodes are forward biased. Find the values of R for which the current is 15 mA.

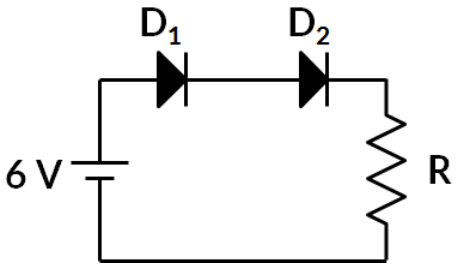

Fig. 3

5. For the ideal diode circuit shown in Fig. 4, let R_f = 1kΩ and R = 9 kΩ. Find the output voltage V_0 when,
   i) $V_1 = V_2 = 0$ V
   ii) $V_1 = 10$ V, $V_2 = 0$ V
   iii) $V_1 = V_2 = 10$ V

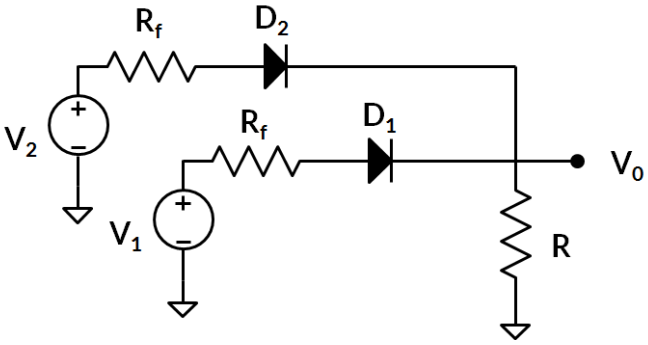

Fig. 4

6. Consider the circuit shown in fig. 5. Determine the current through diode and voltage across the diode. Assume that the cut-in voltage of diode is 0.6 V.

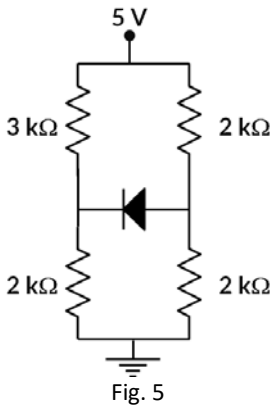

Fig. 5

7. The reverse saturation current of each diode in fig. 6 is 2×10^{-10} A. Determine the input voltage required to produce an output voltage of 0.60 V.

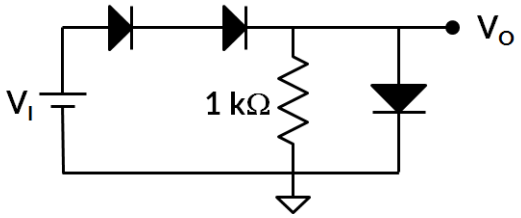

Fig. 6

8. Assume that each diode in circuit shown in fig. 7 has a cut-in voltage of 0.65 V.

   i) If the input voltage is V_I = 5V, determine the value of R_1 such that I_{D1} is one-half of I_{D2}. What are the values of I_{D1} and I_D2?

   ii) If V_I = 8V and R_1 = 2 kΩ, determine I_{D1} and I_{D2}.

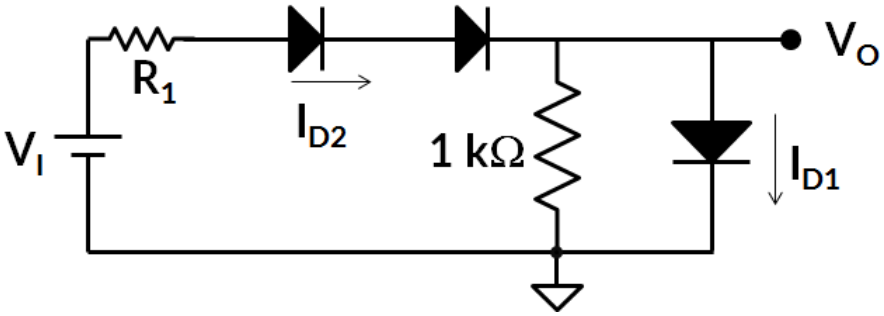

Fig. 7

9. In the circuit shown in fig. 8, find the diode voltage V_D and the supply voltage V such that the current I_D = 0.4 mA. Assume cut-in voltage is 0.7V. What is the power dissipated by the diode?

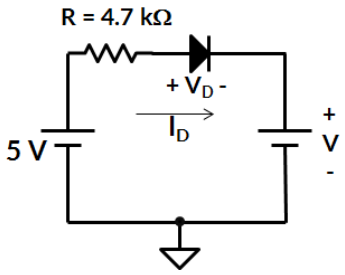

Fig. 8

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Answers:

1) V_D = 0.6 V, I_D = 29 µA
2) i) R_2 = 538 Ω, ii) R_1 = 1.68 kΩ
3) i) R_2 = 110 Ω, ii) R_1 = 8.82 kΩ iii) R_1 = 62 Ω, R_2 = 11 kΩ
4) R = 350 Ω
5) i) V_O = 0 V ii) V_O = 8.46 V iii) V_O = 8.91 V

6) $I_D = 0$ A, $V_D = -0.5$ V
7) $V_I = 1.378$ V
8) i) $I_{D1} = 0.65$ mA, $I_{D2} = 1.3$ mA, $R_1 = 2.35$ kΩ i) $I_{D1} = 2.375$ mA, $I_{D2} = 3.025$ mA
9) V = 2.42 V, P = 0.28 mW