ECE 2210 homework # 22

the answer without showing work.

Name:

Fill in the blanks in the following circuits. For some of the simple calculations, you may simply write down

Assume the diodes are silicon with a 0.7V forward voltage drop:







Assume the LEDs have a 2V forward voltage drop:



Note: In problems 5 and 6 you'll have to make some assumptions about which diode(s) is/are conducting. Work the problem with those assumptions and see if you arrive at impossible answers. If so, change your assumptions and try again.



There are four possible assumptions.

1. Neither diode conducts.

2. Only D_1 conducts.

3. Only D_2 conducts.

4. Both diodes conduct.

NOTE: You don't have to try all four possibilities. As soon as you find one that works, that's the answer. So make your best guess first.









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13. I_R = _____



Warning: If $I_{\rm D}$ turns out negative, it is actually 0 and you must recalculate everything else.

You will need more paper for the next two problems, add a sheet or two.

14. Assume that diode D_1 does conduct. Assume that diode D_2 does NOT conduct.

a) Find V_{R1} , I_{R1} , I_{R3} , I_{D1} , V_{R2} based on these assumptions. Stick with these assumptions even if your answers come out absurd.

$$V_{R1} = ?$$
 $I_{R1} = ?$ $I_{R3} = ?$ $I_{D1} = ?$
 $V_{R2} = ?$



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- b) Was the assumption about D_1 correct? yes or no ECE 2210 How do you know? (Specifically show a value which is or is not within a correct range.)
- c) Was the assumption about D_2 correct? yes or no How do you know?
- 15. In the circuit shown, use the constant-voltage-drop model for the silicon diode.
 - a) Assume that diode D_1 does NOT conduct.

Assume that diode D₂ does conduct.

Find V_{R2} , V_{R1} , I_{R1} , & I_{D2} , based on these assumptions. Stick with these assumptions even if your answers come out absurd. Hint: think in nodal voltages.

$$V_{R2} = ?$$
 $V_{R1} = ?$ $I_{R1} = ?$ $I_{D2} = ?$



- b) Based on your numbers above, does it look like the assumption about D₁ was correct? yes or no How do you know? (Specifically show a value which is or is not within a correct range.)
- c) Based on your numbers above, does it look like the assumption about D₂ was correct? yes or no How do you know?

Answers

1 $V_D := 0.7 \cdot V = V_R := 3.3 \cdot V = I_D := 10 \cdot mA$ 2. $I_D := 0 \cdot mA = V_D := -4 \cdot V = V_R := 0 \cdot V$ 3. $V_D := 0.7 \cdot V = V_R := 7.3 \cdot V = I := 14.3 \cdot mA$ 4. $I := 0 \cdot mA = V_{D2} := -8 \cdot V = V_{D1} := 0 \cdot V = V_R := 0 \cdot V$ 5. $V_{D1} = 0.7 \cdot V + V_{D2} = -1.3 \cdot V + I_1 = 42.3 \cdot mA$ $I_2 = 0 \cdot mA$ 6. $I_{D2} = 0.\text{mA} \quad V_{D1} = 0.7 \cdot \text{V} \quad I_{R2} = 13.8 \cdot \text{mA} \quad I_{R1} = I_{R3} = 9.83 \cdot \text{mA} \quad V_{D2} = -2.17 \cdot \text{V} \quad I_{D1} = I_T = 23.6 \cdot \text{mA}$ 7. $V_{D1} = 0.7 \cdot V = V_{D2} = 0.7 \cdot V = I_{R1} = 0 \cdot mA$ $I_{R2} = 13.8 \cdot mA = I_{D1} = I_{R3} = 11.3 \cdot mA = I_{D2} = I_T = 25.1 \cdot mA$ 8. $V_R = 4 \cdot V$ $R = 267 \cdot \Omega$ 9. $R = 500 \cdot \Omega$ 10. R₁ = $233 \cdot \Omega$ R₃ = $150 \cdot \Omega$ 11. $V_{R} = 6 \cdot V$ $I_{D} = 50 \cdot mA$ $R = 120 \cdot \Omega$ $P_{R} = 0.3 \cdot W$ $P_{D} = 0.6 \cdot W$ 12. $I_L = 40 \cdot mA$ $I_R = 50 \cdot mA$ $I_D = 10 \cdot mA$ $P_R = 0.3 \cdot W$ $P_D = 0.12 \cdot W$ **13.** $I_D = 0.0 \text{ mA}$ $I_L = I_R = 56.3 \text{ mA}$ $V_L = 11.3 \text{ V}$ $P_R = 0.38 \text{ W}$ $P_D = 0.0 \text{ W}$ 14. a) $V_{R1} = 0.7 \cdot V I_{R1} = 14 \cdot mA I_{R3} = 6 \cdot mA I_{D1} = -8 \cdot mA V_{R2} = 0.9 \cdot V$ b) no $I_{D1} = -8 \cdot mA < 0$ c) no $V_{D2} = V_{R2} = 0.9 \cdot V > 0.7V$ 15. a) $V_{R2} = 1.8 \cdot V V_{R1} = 1.2 \cdot V I_{R1} = 24 \cdot mA I_{D2} = -4 \cdot mA$ b) no $V_{D1} = V_{R1} = 1.2 \cdot V > 0.7 V_{R1} = 1.2 \cdot V = 0.7 V_{R1} = 1.2 \cdot V = 0.7 V_{R1} = 1.2 \cdot V = 0.7 V_{R1} = 0.7 \cdot V_{R1} = 0.7 \cdot$ c) no $I_{D2} = -4 \cdot mA < 0$ ECE 2210 homework # 22 p.4