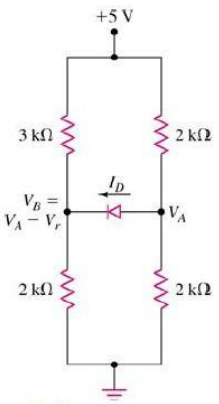
Homework 2 Solutions

Posted Tuesday, September27th, 2016

Each homework problem is worth 10 points unless otherwise stated.

1.44



At node V_A:

(1) $\dfrac{5-V_A}{2} = I_D + \dfrac{V_A}{2}$

At node $V_B = V_A - V_r$

(2) $\dfrac{5-(V_A-V_r)}{2} + I_D = \dfrac{(V_A-V_r)}{2}$

So $\dfrac{5-(V_A-V_r)}{3} + \left[\dfrac{5-V_A}{2} - \dfrac{V_A}{2}\right] = \dfrac{V_A-V_r}{2}$

Multiply by 6:

$10 - 2(V_A - V_r) + 15 - 6V_A = 3(V_A - V_r)$

$25 + 2V_r + 3V_r = 11V_A$

(a) $V_r = 0.6$ V

$11V_A = 25 + 5(0.6) = 28 \Rightarrow V_A = 2.545$ V

From (1) $I_D = \dfrac{5-V_A}{2} - \dfrac{V_A}{2} = 2.5 - V_A \Rightarrow I_D$ Neg. $\Rightarrow \underline{I_D = 0}$

Both (a), (b) $\underline{I_D = 0}$

$V_A = 2.5$, $V_B = \dfrac{2}{5} \cdot 5 = 2$ V $\Rightarrow \underline{V_D = 0.50 \text{ V}}$

1.50

(a) $I_{R2} = I_{D1} = \dfrac{0.65}{1} = \underline{0.65 \text{ mA} = I_{D1}}$

$I_{D2} = 2(0.65) = 1.30 \text{ mA}$

$I_{D2} = \dfrac{V_I - 2V_r - V_0}{R_1} = \dfrac{5 - 3(0.65)}{R_1} = 1.30 \Rightarrow \underline{R_1 = 2.35 \text{ K}}$

(b) $I_{R2} = \dfrac{0.65}{1} = 0.65 \text{ mA}$

$I_{D2} = \dfrac{8 - 3(0.65)}{2} \Rightarrow \underline{I_{D2} = 3.025 \text{ mA}}$

$I_{D1} = I_{D2} - I_{R2} = 3.025 - 0.65$

$\underline{I_{D1} = 2.375 \text{ mA}}$

2.8

(a)

$v_s(\text{max}) = 12 + 2(0.7) = 13.4 \text{ V}$

$v_s(\text{rms}) = \dfrac{13.4}{\sqrt{2}} \Rightarrow \underline{v_s(\text{rms}) = 9.48 \text{ V}}$

(b)

$V_r = \dfrac{V_M}{2f\ R_C} \Rightarrow C = \dfrac{V_M}{2f\ V_r R}$

$C = \dfrac{12}{2(60)(0.3)(150)} \Rightarrow \underline{C = 2222\ \mu\text{F}}$

(c)

$i_d,\ \text{peak} = \dfrac{V_M}{R}\left[1 + \pi\sqrt{\dfrac{2V_M}{V_r}}\right]$

$= \dfrac{12}{150}\left[1 + \pi\sqrt{\dfrac{2(12)}{0.3}}\right]$

$\underline{i_d,\ \text{peak} = 2.33 \text{ A}}$

2.12

(a) $\upsilon_S(peak) = 8.5\left(\sqrt{2}\right) = 12.02 \text{ V}$

$|V_O|_{\text{max}} = 12.02 - 0.7 = 11.32 \text{ V}$

(b) $C = \dfrac{V_M}{2fRV_r} = \dfrac{11.32}{2(60)(10)(0.25)} = 0.03773 \text{ F}$

(c) $\text{PIV} = 2\upsilon_S(peak) - V_\gamma = 2(12.02) - 0.7 = 23.34 \text{ V}$