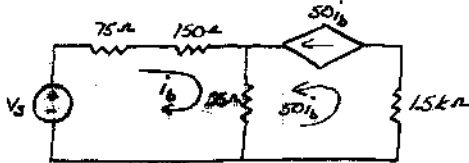


$$\begin{aligned}
 \text{DE 9.3} \quad F_{\text{rms}} &= \sqrt{\frac{1}{3} \left[\int_0^1 t^2 dt + \int_1^2 t^2 dt + \int_2^3 (-1)^2 dt \right]} = \sqrt{\frac{1}{3} \left[\frac{1}{3} t^3 \Big|_0^1 + 4t \Big|_1^2 + t \Big|_2^3 \right]} \\
 &= \sqrt{\frac{1}{3} \left[\left(\frac{1}{3} - 0\right) + (8-4) + (3-2) \right]} = \sqrt{\frac{1}{3} (\frac{1}{3} + 4 + 1)} = \sqrt{\frac{1}{3} (\frac{1}{3} + \frac{15}{3})} = \sqrt{\frac{1}{9} (16)} = \frac{4}{3}
 \end{aligned}$$

PR 9.15a

$$\begin{aligned}
 F_{\text{rms}} &= \sqrt{\frac{1}{20} \left[\int_0^{10} e^{-2t} dt + \int_{10}^{20} e^{-2(t-10)} dt \right]} = \sqrt{\frac{1}{20} \left[\frac{1}{2} e^{-2t} \Big|_0^{10} + \left(\frac{1}{2}\right) e^{-2(t-10)} \Big|_{10}^{20} \right]} \\
 &= \sqrt{\frac{1}{20} \left[-\frac{1}{2} (e^{-20} - 1) + -\frac{1}{2} (e^{-20} - 1) \right]} = \sqrt{\frac{1}{20} [-e^{-20} + 1]} = \frac{1 - e^{-20}}{21.5} = 0.224
 \end{aligned}$$

PR 9.17



$$V_{s,\text{rms}} = \sqrt{\frac{1}{2} \left[\int_0^1 1^2 dt + \int_1^2 (-1)^2 dt \right]} = \sqrt{\frac{1}{2} [(1-0) + (2-1)]} = 1$$

$$\begin{aligned}
 \text{KVL: } -V_s + 75i_b + 150i_b + 25(i_b + 50i_b) &= 0 \\
 \Rightarrow (75 + 150 + 25 + 1250)i_b &= V_s \\
 \Rightarrow 1500i_b &= V_s \\
 \Rightarrow 1500I_{b,\text{rms}} &= V_{s,\text{rms}} \\
 \Rightarrow I_{b,\text{rms}} &= \frac{1}{1500} \text{ A}
 \end{aligned}$$

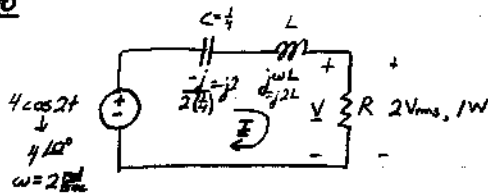
$$P_{75} = I_{b,\text{rms}}^2 75 = \frac{75}{1500^2} = 33.3 \mu\text{W}$$

$$P_{150} = I_{b,\text{rms}}^2 150 = \frac{150}{1500^2} = 66.7 \mu\text{W}$$

$$P_{25} = (I_{b,\text{rms}} + 50I_{b,\text{rms}})^2 25 = \left(\frac{51}{1500}\right)^2 25 = 28.9 \text{ mW}$$

$$P_{15k} = (50I_{b,\text{rms}})^2 (1.5k) = \left(\frac{50}{1500}\right)^2 1.5k = 1.667 \text{ W}$$

PR 9.20



$$|V| = 2\sqrt{2} \quad * P = \frac{V_{\text{rms}}^2}{R} = \frac{2^2}{R} = 1 \Rightarrow R = 4 \Omega$$

$$\begin{aligned}
 * P &= I_{\text{rms}}^2 R = I_{\text{rms}}^2 (4) = 1 \\
 \Rightarrow I_{\text{rms}} &= \frac{1}{2} \\
 \Rightarrow |I| &= \frac{\sqrt{2}}{2} \text{ A}
 \end{aligned}$$

$$\text{loop eqn: } -4\sqrt{2} + (j2)I + j2I + 4I = 0$$

$$\Rightarrow I = \frac{4}{4 + j2 - j2}$$

$$\Rightarrow |I| = \frac{4}{\sqrt{16 + 4L^2 - 8L + 4}}$$

$$\Rightarrow |I|^2 = \frac{16}{4L^2 - 8L + 20} \cdot \left(\frac{\sqrt{2}}{2}\right)^2 = \frac{1}{2} \Rightarrow 32 = 4L^2 - 8L + 20 \Rightarrow 4L^2 - 8L - 12 = 0$$

$$\Rightarrow L = \frac{8 \pm \sqrt{64 - 4(4)(-12)}}{8}$$

$$= \frac{8 \pm \sqrt{256}}{8}$$

$$= \frac{8 \pm 16}{8}$$

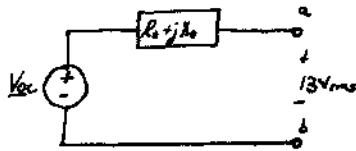
$$= \textcircled{3} -1$$

$$R = 4 \Omega$$

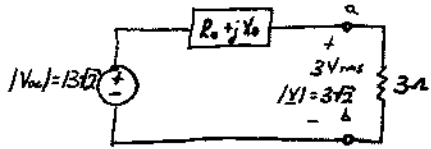
$$L = 3 \text{ H}$$



PR 9.21



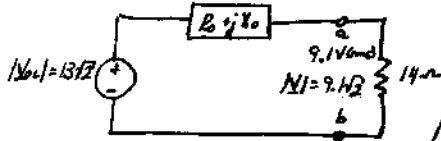
$$\Rightarrow |V_{oc}| = 13\sqrt{2} \text{ V}$$



$$|I| = \frac{|V_{oc}| \cdot 3}{\sqrt{(R_0 + 3)^2 + X_0^2}} \Rightarrow 3\sqrt{2} = \frac{13\sqrt{2} \cdot 3}{\sqrt{R_0^2 + 6R_0 + 9 + X_0^2}}$$

$$\Rightarrow R_0^2 + 6R_0 + 9 + X_0^2 = 169$$

$$\Rightarrow R_0^2 + 6R_0 + X_0^2 = 160$$



$$|I| = \frac{|V_{oc}| \cdot 14}{\sqrt{(R_0 + 14)^2 + X_0^2}} \Rightarrow 9.1\sqrt{2} = \frac{13\sqrt{2} \cdot 14}{\sqrt{R_0^2 + 28R_0 + 196 + X_0^2}}$$

$$\Rightarrow R_0^2 + 28R_0 + 196 + X_0^2 = \frac{(13^2 \cdot 14)^2}{9.1^2}$$

$$\Rightarrow R_0^2 + 28R_0 + 196 + X_0^2 = 400$$

$$\Rightarrow R_0^2 + 28R_0 + X_0^2 = 204$$

2 eqns, 2 unknowns: subtract

$$R_0^2 - R_0^2 + 6R_0 - 28R_0 + X_0^2 - X_0^2 = 160 - 204$$

$$\Rightarrow -22R_0 = -44$$

$$\Rightarrow R_0 = 2 \Omega$$

$$X_0^2 = 204 - R_0^2 - 28R_0$$

$$= 204 - 4 - 56$$

$$= 144$$

$$\Rightarrow X_0 = \pm 12$$

$$R_0 = 2 \Omega$$

$$|X_0| = 12 \Omega$$