Answer to the Homework Problems:

Homework 1:

10.11 8.84 cos(100t-45°)

10.19 (a) 7.79+ j4.5
(b) 6.74- j0.023
(c) 7.67+ j87.5
(d) 3.15+ j2.5
(e) 289.27+ j241.045

10.26 (a) 11∠-90°
(b) 11∠0°
(c) 11∠-90°
(a) 4.24∠45°

10.40 (a) 23.24∠-12.9° Ω
(b) 12.08∠-13.78° Ω
(c) 11.14∠-1.54° Ω

10.42 (a) 15∠-33.13° V
(b) 15∠-73.13° V
(c) 9∠-20° V
(d) 20.13∠-43.44° V

10.44 $i(t)$ = 2.98 cos(100t – 46.48°) A

Homework 2:

10.48 (a) 2.5cos10 mA
(b) 1.5cos(10t - 42°) mA
(c) 0.4843cos(10t -16.48°)

10.51 0.809 ∠-4.8°

10.54 41.9∠134.8° V

10.62 V_1 = 493.18∠-162.14° V, V_2 = 274.46∠-100.34° V

10.64 $Z_{thevenin}$ = 4.77∠34.32° ohm, V_{th}=9.61 ∠64.55° V,

$I_1 = 1.6\angle 57.92°$ A

10.69 $24\cos^2(20t - 163°)$ W

10.71 (b) I_s leads I_R by 83°; I_C by -7°; I_x by 146°

Homework 3:

11.5 $p_R(t)=96\ e^{-t/.03}$ W

$p_C(t) = -96\ e^{-t/.03}$ W

$p_R(60ms) = 13$ W

11.11 a) $P_l(t) = 0.73+1.16\cos(90t-21°)$W

b) $P_l(t) = 0.73$W

11.14 $P_R = 2129$W

$P_{s1} = -230$W, $P_{s2} = -1899$W

$P_L = 0$W, $P_C = 0$W

11.19 (a) $P_{4.8\Omega} = 69.6$W, $P_{8\Omega}=36$W

(b) $p_{-j2A} = -9.6$W, $P_{1.6Ix} = -96$W

(c) $Z_{th} = -8+j3.2\ \Omega$

11.25 $f_o=0.167$ Hz, T = 6s

$I_{eff} = 1.291$ A rms

$f_o=250$ Hz, T = 4 ms

$I_{eff} = 1.443$ A rms

11.26 (a) $i_{avg} = -3$mA, $i_{eff} = 5.196$mA rms

(b) $f_{avg} = 0$, $f_{rms} = 0.333*10^{-3}$ rms

11.30 (a) $v_{avg} = 1$V, $v_{eff} = 1.225$V rms

Homework 4:

11.34 (a) Voltage lags current by 126°

(b) Voltage leads current by 56.6°

(c) Voltage lags current by 46.76°

(d) Voltage lags current by 78.46°

11.36 a) P_{load} (20ms) = 1.192W

b) $P_{1K\Omega} = 98$mW, $P_{load} = -333$mW

c) AP_{load} (apparent power) = 1.92VA
d) PF_{source} = 0.125 leading 11.37 (a) PF_{source} = 1
(b) 0.9523 lagging (c) 0.9983 leading

11.37 **(a) PF_{source} = 1**
(b) 0.9523 lagging
(c) 0.9983 leading

11.41 **(a) AP=1.118 KVA, PF= 0.894 lagging. Q=500 VAR**
(b) AP= 400 VA, PF= 1, Q=0 VAR
(c) AP= 150 VA, PF= 0.93 leading, Q= -53.75 VAR
(d) AP=75 VA, PF=.906 lagging, Q= 31.7 VAR

11.45 **360.85 μF**

11.47 **$S_{j30\Omega}$ = 88.4∠90° VA $S_{10\Omega}$ = 20∠ 0° VA**
$S_{15\Omega}$ = 3.54∠0° VA $S_{-j25\Omega}$ = 5.9∠-90° VA
S_{source} = 85.85∠74.05 ° VA
PF_{source} = 0.275 lagging

Homework 5:

12.12 **(a) P_1 = 0.55 W, P_2 = 5.34 W**
(b) $P_{200\Omega}$ = 66 W, $P_{50\Omega}$=255.38W, $P_{10\Omega}$=2.025 W
(c) PF = 0.954

12.19 **(a) Z_P = 0.926 – 0.261j**

$$Van = \frac{208}{\sqrt{3}} \angle -30° \text{ V}$$

$$Vbn = \frac{208}{\sqrt{3}} \angle -150° \text{ V}$$

$$Vcn = \frac{208}{\sqrt{3}} \angle 90° \text{ V}$$

(b) V_{aA} = 208∠0° V
V_{bB} = 208∠-120° V
V_{cC} = 208∠120° V
(c) I_{aA} = 216.19∠15.7° A

$I_{bB} = 216.19\angle -104.3^\circ$ A

$I_{cC} = 216.19\angle 135.7^\circ$ A

(d) P = 129.84 kW

12.21 a) Power Factor = 0.9688 leading

b) P = 22.76kW

c) Power Factor = 0.9803 leading, P = 18.36kW

12.31 R = 0.66 Ω

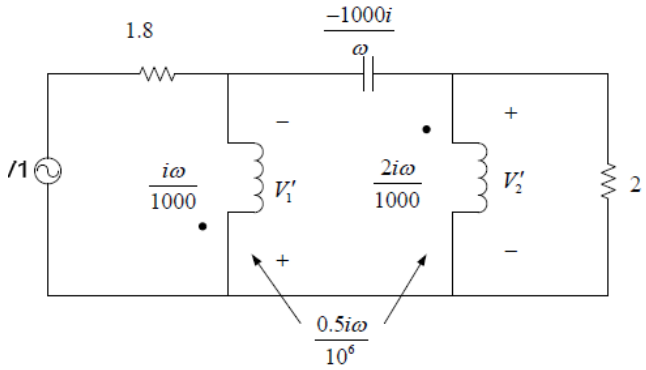
12.32 $I_{bB}=36.08\angle 95.54^\circ$ A, $V_{an}=(160/\sqrt{3}) \angle 240^\circ$ V

12.34 $I_{aA}= 3.727$ A, $I_{AB}= 2.152$ A, $V_{an}=176.91\angle 20.73^\circ$ V

Homework 6:

13.11 $V_2/V_1 = -2j\omega(4\omega^2+(2+6j\omega)(1+4j\omega))$

13.12 (a)



13.16 $v_{AG}(t) = -40\sin t$

13.18 $i_1(t) = 0.36 \sin(3t-70.86°)$

$i_2(t) = 0.126 \sin(3t+176.82°)$

$i_3(t) = 0.114 \sin(3t+1.457°)$

13.21 (a) $(4 - j5\omega)I_1 - j4\omega I_3 = 0$

$(6 + j5\omega)I_1 - j2\omega I_2 - 6I_3 = 0$

$-6I_1 - j4\omega I_2 + (11 + j6\omega)I_3 = 0$

(b) $I_3 = -3.88+j1.79$

Homework 7:

13.31 155 nH,-25 nH,38 nH

13.38 v_o = -4.1 cos1000t -4.5sin1000t

13.40 (a) $I_2 = 24/\sqrt{2} \angle 77°$ A, $V_2 = 24 \angle 32°$ V

(b) I_2 = infinity, $V_2 = 24 \angle 32°$

(c) $I_2 = 8 \angle 98°$ A, $V_2 = 12 \angle 118°$ V

13.42 8.88 mW and 467 mW

13.45 V1=-0.75V V2=- 45/26 V

Power dissipated by 100Ω, 4Ω, 2Ω and 2.7 kΩ are 15mW,16.9mW,0.562mW and 2.24mW, respectively

13.54 (b) $V_2 = -0.9973 \angle -15°$ V, $P_{8\Omega}$ = 62.16 mW

Homework 8:

14.2 (a) -1

(b) $0.2 \angle 110°$

(c) -0.5617 –j5.0769

(d) $17.84\, e^{-j(56.26° + 2t)}$

14.11 (a) $\mathrm{Re}[19\, e^{5t+j84}]$

(b) $\mathrm{Re}[19e^{j84}]$

(c) $\mathrm{Re}[19e^{j84}\, e^{(-4+j)t}]$

14.20 (a) $185.35 \angle -47.58°$

(b) $185.35e^{-3t}\cos(4t-47.58°)$ V

14.49 (a) $V(t) = 5i(t) + 5\int i(t)dt$

(b) $I(s) = \frac{2}{5}\frac{1}{s+1}$

(c) $i(t) = \frac{2}{5}e^{-t}u(t)$

15.9 V_s = 0.2s*(2/(s+2) +0.1)/(0.2s+1000)

v(t) = 0.1δ (t) –(498 e^{-5000t} -0.0008e^{-2t}) u(t)

15.11 $I_1(t) = (2.9\, e^{-0.67t} - 0.6e^{-1.5t} - 2e^{t})u(t)$

$I_2(t) = e^{-1.5t}u(t)$

$I_3(t) = (1.33 - 0.33\, e^{-1.5t})u(t)$

15.19 $i_1(t) = 936\cos 2t - 270\sin 2t$

Homework 9:

16.4 (a) 0.5
(b) 62.7 and 159.5 rad/s

16.10 B = 210.8 rad/s
(a) 47.42 Ω
(b) $25.8\angle 57°$ Ω
(c) $44.7\angle -20°$ Ω
(d) $4.3\angle 85°$ Ω

16.15 (a) 750kΩ
(b) $i(t) = 3.92\cos(4.25*10^6 t - 89.99°)$

16.31 Sketch the plots

16.40 Design problem (many possible solutions)

16.41 Design problem (many possible solutions)

Homework 10:

17.11 $Y = \begin{bmatrix} 11*10^{-4} & -10^{-4} \\ -10^{-4} & 1/8000 + 1/10000 \end{bmatrix}$

17.33 $Z = \begin{bmatrix} 125 & 25 \\ 25 & 75 \end{bmatrix}$

17.41 $h1 = \begin{bmatrix} 50\ \text{ohms} & 1 \\ -1 & 40\text{ms} \end{bmatrix}$

$h2 = \begin{bmatrix} 1.67\ \text{ohms} & 0.67 \\ -0.67 & 13.3\text{ms} \end{bmatrix}$

17.53 (a) $\begin{bmatrix} 16.8 & 1.87*10^4 \\ 0.004 & 4.2 \end{bmatrix}$

(b) $\begin{bmatrix} 6.67 & 1.14 * 10^{4} \\ 8.26 * 10^{-3} & 1.43 \end{bmatrix}$