Chapter **33** (Benson)

E01 $L=40\,\text{mH}$ & $V_0=120\,\text{V}$: (**a**) $f=60\,\text{Hz}$, $i_0=v_0/(2\pi fL)=7.96\,\text{A}$; (**b**) $f_2=f_1/0.3=200\,\text{Hz}$.

E02 $C=50\,\mu\text{F}$ & $v_0=70\,\text{V}$: (**a**) $f=50\,\text{Hz}$, $i_0=v_0(2\pi fC)=1.10\,\text{A}$; (**b**) $f_2=f_1\times 0.3=65\,\text{Hz}$.

E06 $L=72\,\text{mH}$, $v_0=50\,\text{V}$ & $f=120\,\text{Hz}$: (**a**) $i_0=v_0/\omega L=0.921\,\text{A}$; (**b**) $i=0$; (**c**) $0.5=\cos(\omega t)\rightarrow \omega t=\pi/3;\ 5\pi/3$, $i=i_0\sin(\omega t)=\pm 0.798\,\text{A}$; (**d**) At $t=1\,\text{ms}$, $p=i_0v_0\sin(2\omega t)/2=23.0\,\text{W}$.

E07 $C=108\,\mu\text{F}$, $v_0=24\,\text{V}$ & $f=80\,\text{Hz}$: (**a**) $i_0=v_0\omega C=1.3\,\text{A}$; (**b**) $i=0$; (**c**) $0.5=-\cos(\omega t)\rightarrow \omega t=2\pi/3;\ 4\pi/3$, $i=i_0\sin(\omega t)=\pm 1.13\,\text{A}$; (**d**) At $t=1\,\text{ms}$, $p=-i_0v_0\sin(2\omega t)/2=-13.2\,\text{W}$.

E19 $R=10\,\Omega$, $L=40\,\text{mH}$, $V=120\,\text{V}$, $f=60\,\text{Hz}$ & $V_R=30\,\text{V}$: (**a**) $I=V_R/R=V/Z\rightarrow Z=40\,\Omega$. $Z^2=R^2+(\omega L-1/\omega C)^2\rightarrow C=49\mu\text{F}$; (**b**) $f_0=1/2\pi\sqrt{LC}=113\,\text{Hz}$.

E20 $R=25\,\Omega$, $L=320\,\text{mH}$, $C=18\mu\text{F}$, $v_0=170\,\text{V}$ & $f=60\,\text{Hz}$: (**a**) $Z=[R^2+(\omega L-1/\omega C)^2]^{1/2}=36.6\,\Omega$; (**b**) $I=v_0/(Z\sqrt{2})=3.28\,\text{A}$; (**c**) $\tan\phi=(\omega L-1/\omega C)/R\rightarrow \phi=-47^0$.

E25 $V=100\,\text{V}$, $f=90\,\text{Hz}$, $R=20\,\Omega$, $C=80\mu\text{F}$ & $L=9\,\text{mH}$: (**a**) $X=X_L-X_C=17\,\Omega$, $Z=26.2\,\Omega\rightarrow \cos\phi=R/Z=0.762$; (**b**) $P=I^2R=(V/Z)^2R=291\,\text{W}$.

E27 $v_0=200\,\text{V}$, $f=50/\pi\,\text{Hz}$, $R=15\,\Omega$, $C=200\mu\text{F}$ & $L=0.2\,\text{H}$: (**a**) $X_L=20\,\Omega$, $X_C=50\,\Omega$; (**b**) $\tan\phi=(X_L-X_C)/R\rightarrow \phi=-63.4^0$; (**c**) $P=(V/Z)^2R=267\,\text{W}$; (**d**) $\cos\phi=P/IV=0.447$.

E33 $R=24\,\Omega$, $L=18\,\text{mH}$, $C=70\mu\text{F}$ & $i=0.06\sin(320\,t)\,\text{A}$:
$\phi=-1.02\,\text{rad}$, $Z=45.7\,\Omega$, $v_0=i_0Z=2.74=\text{V}\rightarrow v=2.74\sin(320\,t-1.02)\,\text{V}$.

P01 $P=V^2R/[R^2+(\omega L-1/\omega C)^2]=\omega^2RV^2/[\omega^2R^2+L^2(\omega^2-1/LC)^2]$
$=\omega^2RV^2/[\omega^2R^2+L^2(\omega^2-\omega_0^2)^2]$. (Teacher: Jyh-Shinn Yang, 90.06.06)

P04 Phasors: $i=i_R+i_C+i_L$, $i_0^2=i_{0R}^2+(i_{0L}-i_{0C})^2=v_0^2[1/R^2+(1/X_L-1/X_C)^2]\rightarrow Z=v_0/i_0=1/\sqrt{1/R^2+(1/X_L-1/X_C)^2}$.

P06 $R^2+(\omega_lL-1/\omega_lC)^2=R^2+(\omega_hL-1/\omega_hC)^2$, $L(\omega_h+\omega_l)=(\omega_h+\omega_l)/(\omega_h\omega_lC)\rightarrow \omega_h\omega_l=1/LC=\omega_0^2$ or $f_0=\sqrt{f_hf_l}$.

E31 $P=IV\cos\phi=V^2\cos\phi/Z$,
but $R=Z\cos\phi$, so $P=(V\cos\phi)^2/R=V_R^2/R$.