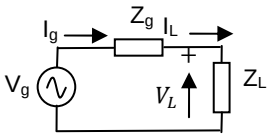
ETSETB. RADIATION AND PROPAGATION. Test: basic concepts on linear circuits

Name:	ID								
	Code		X	Y			Z		

Each datum values one point: 8 points total.

TEST CODE: **X=** **Y=** **Z=**

P1.- The circuit at the right works in sinusoidal steady state. The source open circuit voltage is given by $V_g = 10e^{j\frac{\pi}{2}}$ V. The voltage and current phasors at the load are $V_L = |V_L|e^{j\varphi_V}$ and $I_L = |I_L|e^{j\varphi_I}$ respectively. **All values are rms**. Find the following magnitudes:



Z=1 or 2:	Z= 3 or 4	Z= 5 or 6	Z= 7 or 8	Z=9 or 0
$\boldsymbol{Z_L}$=(20+X)·(1+j) Ω $\boldsymbol{V_L}$=-10·(1-j) V_e $\boldsymbol{I_L}$=_____ mA_e $\boldsymbol{Z_g}$=_____ Ω	$\boldsymbol{Z_g}$=(30+X)·(1-j) Ω $\boldsymbol{I_L}$=90·(1+j) mA_e $\boldsymbol{V_L}$=_____ V_e $\boldsymbol{Z_L}$=_____Ω	$\boldsymbol{Z_L}$=(40-X)·(1+j) Ω $\boldsymbol{Z_G}$=(20+X)·(1-j) Ω $\boldsymbol{V_L}$=_____ V_e $\lvert I_L\rvert$ =_____mA_e φ_I_____ deg	$\boldsymbol{Z_g}$=(40-X)·(1+j) Ω $\boldsymbol{V_L}$=5-3j V_e $\boldsymbol{I_L}$=_____ mA_e $\boldsymbol{Z_L}$=_____Ω	$\boldsymbol{Z_L}$=(30-X)·(1-j) Ω $\boldsymbol{Z_g}$=(20+X)·(1+j) Ω $\boldsymbol{I_L}$=_____ mA_e $\lvert V_L\rvert$ =_____V_e φ_V_____ deg

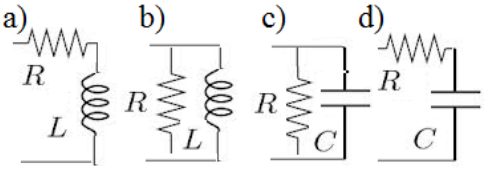
(*)Each section values 2 points regardless of the number of requested values

P2.- In a circuit similar to the one given in the previous exercise, find the power delivered to the load, $\boldsymbol{P_L}$ (mW), taking into account the following parameters:

Z=1 or 2:	Z= 3 or 4	Z= 5 or 6	Z= 7 or 8	Z=9 or 0
$\boldsymbol{Z_L}$=(30+Y)·(1+j) Ω $\boldsymbol{V_L}$=20·(1+2j) V_e $\boldsymbol{P_L}$=_____ W	$\boldsymbol{Y_L}$=(40+Y)·(2-j) $mS^{(*)}$ $\boldsymbol{I_L}$=700·(1+2j) mA_e $\boldsymbol{P_L}$=_____ W	$\boldsymbol{V_L}$=(30-Y)·(2+j) V_e $\boldsymbol{I_L}$=4Y0·(3-j) mA_e $\boldsymbol{P_L}$=_____ W	$\boldsymbol{Y_L}$=(30+Y)·(1+j) $mS^{(*)}$ $\boldsymbol{I_L}$=400·(2+j) mA_e $\boldsymbol{P_L}$=_____ W	$\boldsymbol{Z_L}$=(40-Y)·(2+j) Ω $\boldsymbol{V_L}$=30·(2-j) V_e $\boldsymbol{P_L}$=_____ W

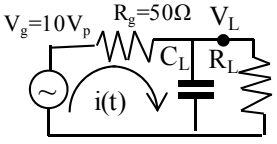
$^{(*)}$*mS=miliSiemens. Voltage and current values are RMS*

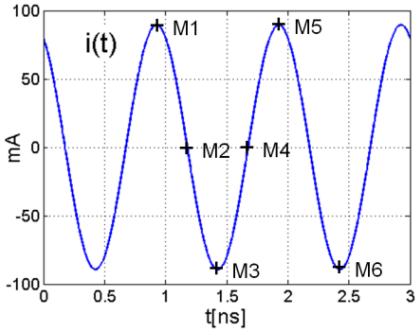
P3.- A generator works at a frequency $\boldsymbol{f}$=5X0 MHz in a sinusoidal steady state. Its internal impedance is $\boldsymbol{R_g}$=50 Ω and its rms open circuit voltage is $\boldsymbol{V_g}$=(10+Y) V. The source is loaded with a reactive impedance $\boldsymbol{Z_L}$ ($\boldsymbol{Z_L}$=1/$\boldsymbol{Y_L}$) given by one of the configuration RC or RL detailed in the right figure (R=100 Ω, $L = \frac{100}{\pi}$ nH and $C = \frac{20}{\pi}$ pF). Find the value of this complex load ($\boldsymbol{Z_L}$ o $\boldsymbol{Y_L}$) and the power $\boldsymbol{P_L}$ (mW) that the source is delivering to it.



Z=1 or 2:	Z= 3 or 4	Z= 5 or 6	Z= 7 or 8	Z=9 or 0
Case a) $\boldsymbol{Y_L}$= $mS^{(*)}$ $\boldsymbol{P_L}$=_____ mW	***Case b)*** $\boldsymbol{Z_L}$= Ω $\boldsymbol{P_L}$=_____ mW	***Case c)*** $\boldsymbol{Z_L}$= Ω $\boldsymbol{P_L}$=_____ mW	***Case d)*** $\boldsymbol{Y_L}$= $mS^{(*)}$ $\boldsymbol{P_L}$=_____ mW	***Case a)*** $\boldsymbol{Y_L}$= $mS^{(*)}$ $\boldsymbol{P_L}$=_____ mW

P4.- The RC load in the figure at the right is fed by means of a generator with open circuit voltage given by $V_g(t) = 10 \cdot cos(wt)$ V and internal impedance R_g=50 Ω. The current $i(t) = I_p cos(wt + \varphi_I)$ mA supplied by the generator is measured with an oscilloscope that gives the screen markers M1 to M6. If $V_L(t) = V_p cos(wt + \varphi_V)$ find:





Z=1 or 2:	Z= 3 or 4	Z= 5 or 6	Z= 7 or 8	Z=9 or 0
M1=[0,9254, 89,44] M3=[1,426, -89,44] $\boldsymbol{f}$= MHz φ_I = deg $\varphi_I \in [0, 360º]$ $\boldsymbol{V_p}$= V (peak)	M4=[1,676, 0] M5=[1,926, 89,44] $\boldsymbol{f}$= MHz I_p = (mA rms) φ_V = rad $\varphi_V \in [0, 2\pi]$ rad	M2=[1,176, 0] M3=[1,426, -89,44] $\boldsymbol{f}$= MHz φ_I = rad $\varphi_I \in [0, 2\pi]$ rad $\boldsymbol{V_p}$= V (rms)	M3=[1,426, -89,44] M6=[2.426, -89,44] $\boldsymbol{f}$= MHz φ_I = deg $\varphi_I \in [0, 360º]$ $\boldsymbol{V_p}$= V (peak)	M5=[1,926, 89,44] M6=[2.426, -89,44] $\boldsymbol{f}$= MHz I_p = (mA peak) φ_V = deg $\varphi_V \in [0, 360º]$

Optional: Find the value of $\boldsymbol{C_L}$ (pF) and $\boldsymbol{R_L}$ (Ω)

SOLUTIONS CORRECTION FOR SEVERAL CODES X-Y-Z

CODIGO PRUEBA: X=1 Y=2 Z=3
PROBLEMA 1
DATOS Vg=0+10iVe, Zg=31-31i Ohm. IL=90+90i mAe
SOL P1 VL=-5.6+10i Ve. ZL=24.6+86.6i Ohm

PROBLEMA 2
DATOS P2: YL=84-42i mS, IL=700+1400i mAe
SOL P2 PL=23.3 W

PROBLEMA 3
DATOS P3: f=510 MHz, Vg=12 Ve
SOL P2 ZL=51+50i Ohm, PL=578.2 mW

PROBLEMA 4
SOL P3 f=1000 MHz, Ip=63.2 mA eficaces, phi_V=5.96 rad

SOL Opcional RL=100.3 Ohm, CL=5/pi pF
%%%
CODIGO PRUEBA: X=3 Y=4 Z=5

PROBLEMA 1
DATOS Vg=0+10i Ve, ZL=37+37i Ohm. Zg=23-23iOhm
SOL P1 VL=-4.5+7.2i Ve. ILmod=162.3 mAe, Fase IL=76.9 grados

PROBLEMA 2
DATOS P2: VL=52+26i Ve, IL=1320-440i mAe
SOL P2 PL=57.2 W

PROBLEMA 3
DATOS P3: f=530 MHz, Vg=14 Ve
SOL P2 ZL=18.2-38.6i Ohm, PL=581 mW

PROBLEMA 4
SOL P3 f=1000 MHz, phi_I=0.46rad, Vp=4.5 V eficaces

SOL Opcional RL=100.3 Ohm, CL=5/pi pF
&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&&
CODIGO PRUEBA: X=5 Y=6 Z=7

PROBLEMA 1
DATOS Vg=0+10i ve, Zg=35+35i Ohm. VL=5-3i Ve
SOL P1 IL=114.3+257.1i mAe. ZL=-2.5-20.6i Ohm

PROBLEMA 2
DATOS P2: YL=36+36i mS, IL=400+200i mAe
SOL P2 PL=2.8 W

PROBLEMA 3
DATOS P3: f=550 MHz, Vg=16 Ve
SOL P2 YL=8.3+3.8i mS, PL=1042.1 mW

PROBLEMA 4
SOL P3 f=1000 MHz, phi_I=26.6º, Vp=6.3 V pico

SOL Opcional RL=100.3 Ohm, CL=5/pi pF

CODIGO MATLAB PARA LA CORRECCION DEL PROBLEMA SEGUN VARIABLES X-Y-Z

```
%Problemas_Circuitos_Lineales.m
% Código para generar los datos y las soluciones del tema introductorio de Circuitos Lineales
%Francesc Torres 01/02/2014
clear
flag_loop_ON=1;  %1 siempre para mantenerse en el bucle de correccion. Salida bucle con CTR-C
flag_control=input('Entrar 1 para visualizar el cálculo de control, 0 para omitirlo. Control=');

%Inicio bucle correccion con entrada codigo

while flag_loop_ON==1

%CODIGO PRUEBA
disp(' ')
disp(' ')
disp ('CORRECCIÓN PROBLEMA CIRCUITOS LINEALES (press CTL-C to end)');
XYZ=input('CODIGO PRUEBA (3 cifras)=    ?');
X=floor(XYZ/100);
Y=floor( (XYZ-100*X)/10 );
Z=XYZ-100*X-10*Y;
disp(['CODIGO PRUEBA:  X=', num2str(X), ' Y=', num2str(Y),'     Z=', num2str(Z)])
disp('  ')
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
disp(' ')
switch_cases=Z;

%DATOS COMUNES PROBLEMAS
disp('PROBLEMA 1')
%PROBLEMA 1
Vg=10*exp(1i*pi/2);  %Tensión generador en c.a.

switch switch_cases
   case {1,2}
      ZL=(20+X)*(1+1i);
      VL=-10*(1-1i);
      Zg=(Vg/VL-1)*ZL;
      IL=VL/ZL;
       disp (['DATOS  Vg=', num2str(round(10*Vg)/10),' Ve,  ZL=',num2str(ZL), ' Ohm. VL=',
num2str(VL),' Ve']);
       disp (['SOL P1 IL=',num2str(round(10*IL*1e3)/10), ' mAe. Zg=', num2str(round(10*Zg)/10),'
Ohm']);
       %control
       if flag_control==1
       ZLctl=Zg*VL/(Vg-VL);
       VLctl=Vg-IL*Zg;
       Vgctl=VL+IL*Zg;
       disp (['CTL P1 Vg=',num2str(round(10*Vgctl)/10),'Ve, ZL=',num2str(ZLctl), ' Ohm, VL=',
num2str(VLctl),' Ve']);
       end
   case {3,4}
      Zg=(30+X)*(1-1i);
      IL=90*(1+1i)*1e-3;
      VL=Vg-IL*Zg;
      ZL=VL/IL;
       disp (['DATOS   Vg=', num2str(round(10*Vg)/10),'Ve, Zg=',num2str(Zg), ' Ohm. IL=',
num2str(IL*1e3),' mAe']);
       disp (['SOL P1 VL=',num2str(round(10*VL)/10), ' Ve. ZL=', num2str(round(10*ZL)/10),' Ohm']);
       %control
       if flag_control==1
       Zgctl=ZL*(Vg-VL)/VL;
       Vgctl1=VL+IL*Zgctl; Vgctl2=VL*(ZL+Zgctl)/ZL;
       disp (['CTL P1 Vg=', num2str(round(10*Vgctl1)/10),' Ve, Zg=',num2str(Zgctl), ' Ohm,  IL=',
num2str(IL*1e3),' mAe, Vg=', num2str(round(10*Vgctl2)/10),' Ve  ']);
       end

   case {5,6}
      ZL=(40-X)*(1+1i);
      Zg=(20+X)*(1-1i);
      VL=Vg*ZL/(ZL+Zg);
      ILmod=abs(VL/ZL);
      ILphase=angle(VL/ZL)*180/pi;
       disp (['DATOS  Vg=', num2str(round(10*Vg)/10),' Ve, ZL=',num2str(ZL), ' Ohm.
Zg=',num2str(Zg),'Ohm']);
       disp (['SOL P1 VL=',num2str(round(10*VL)/10), ' Ve. ILmod=', num2str(round(10*ILmod*1e3)/10),'
mAe, Fase IL=', num2str(round(10*ILphase)/10),' grados']);
       %control
       if flag_control==1
       ILctl=ILmod*exp(1i*ILphase*pi/180);
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       ZLctl=VL/ILctl;
       Zgctl=(Vg-VL)/ILctl;
       Vgctl=VL+ILctl*Zgctl;
       disp (['CTL P1 Vg=', num2str(round(10*Vgctl)/10),' Ve, ZL=',num2str(ZLctl), ' Ohm, ZgL=',
num2str(Zgctl),' Ohm']);
       end

   case {7,8}
      Zg=(40-X)*(1+1i);
      VL=5-3*1i;
      IL=(Vg-VL)/Zg;  %Ig=IL
      ZL=Zg*VL/(Vg-VL);
      disp (['DATOS  Vg=', num2str(round(10*Vg)/10),' ve, Zg=',num2str(Zg), ' Ohm. VL=', num2str(VL),'
Ve']);
      disp (['SOL P1 IL=',num2str(round(10*IL*1e3)/10), ' mAe. ZL=', num2str(round(10*ZL)/10),' Ohm']);
       %control
       if flag_control==1
       Zgctl=(Vg-VL)/IL;
       VLctl1=Vg-IL*Zg; VLctl2=IL*ZL;
       Vgctl=VLctl1+IL*Zg;
       disp (['CTL P1  Vg=', num2str(round(10*Vgctl)/10),' Ve, Zg=',num2str(Zgctl), ' Ohm, VL=',
num2str(VLctl1),' Ve, VL=', num2str(VLctl2),' Ve  ']);
       end

   case {9,0}
      ZL=(30-X)*(1-1i);
      Zg=(20+X)*(1+1i);
      IL=Vg/(ZL+Zg);
      VLmod=abs(IL*ZL);
      VLphase=angle(IL*ZL)*180/pi;
       disp (['DATOS  Vg=', num2str(round(10*Vg)/10),' Ve, ZL=',num2str(ZL), ' Ohm.
Zg=',num2str(Zg),'Ohm']);
       disp (['SOL P1 IL=',num2str(round(10*IL*1e3)/10), ' mAe. VLmod=', num2str(round(10*VLmod)/10),'
Ve, Fase VL=', num2str(round(10*VLphase)/10),' grados']);
       %control
       if flag_control==1
       VLctl=VLmod*exp(1i*VLphase*pi/180);
       ZLctl=VLctl/IL;
       Zgctl=(Vg-VLctl)/IL;
       Vgctl=VLctl+IL*Zgctl;
       disp (['CTL P1  Vg=', num2str(round(10*Vgctl)/10),' Ve, ZL=',num2str(ZLctl), ' Ohm, ZgL=',
num2str(Zgctl),' Ohm']);
       end
end

disp(' ')
disp('PROBLEMA 2')
switch switch_cases
   case {1,2}
       ZL=(30+Y)*(1+1i); VL=20*(1-1i);
       YL=1/ZL; IL=VL/ZL;
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['DATOS P2: ZL=', num2str(ZL),' Ohm, VL=', num2str(VL),' Ve'])
       disp (['SOL P2 PL=',num2str(round(10*PL)/10), ' W']);
   case {3,4}
       YL=(40+Y)*(2-1i)*1e-3; IL=700*(1+2i)*1e-3;
       ZL=1/YL; VL=IL*ZL;
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['DATOS P2: YL=', num2str(YL*1e3),' mS, IL=', num2str(IL*1e3),' mAe'])
       disp (['SOL P2 PL=',num2str(round(10*PL)/10), ' W']);
   case {5,6}
       VL=(30-Y)*(2+1i); IL=(400+10*Y)*(3-1i)*1e-3;
       ZL=VL/IL; YL=IL/VL;
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['DATOS P2: VL=', num2str(VL),' Ve, IL=', num2str(IL*1e3),' mAe'])
       disp (['SOL P2 PL=',num2str(round(10*PL)/10), ' W']);
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   case {7,8}
       YL=(30+Y)*(1+1i)*1e-3; IL=200*(2+i)*1e-3;
       ZL=1/YL; VL=IL*ZL;
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['DATOS P2: YL=', num2str(YL*1e3),' mS, IL=', num2str(IL*1e3),' mAe'])
       disp (['SOL P2 PL=',num2str(round(10*PL)/10), ' W']);
   case {9,0}
      ZL=(40-Y)*(2+1i); VL=30*(2-1i);
      YL=1/ZL; IL=VL/ZL;
      PL=real(VL*conj(IL));
      PLctl1=abs(VL)^2*real(YL);
      PLctl2=abs(IL)^2*real(ZL);
      if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
      end
      disp (['DATOS P2: ZL=', num2str(ZL),' Ohm, VL=', num2str(VL),' Ve'])
      disp (['SOL P2 PL=',num2str(round(10*PL)/10), ' W']);
end

disp(' ')
disp('PROBLEMA 3')
%Datos comunes
Vg=10+Y;
Rg=50; R=100; C=20/pi*1e-12; L=100/pi*1e-9;
f=(500+10*X)*1e6;
ZC=-1i/(2*pi*f*C); YC=1/ZC;
ZB=1i*2*pi*f*L; YB=1/ZB;
disp (['DATOS P3: f=', num2str(f/1e6),' MHz, Vg=', num2str(Vg),' Ve']);
switch switch_cases
   case {1,2}
       ZL=R+ZB; YL=1/ZL;
       IL=Vg/(Rg+ZL);
       VL=Vg*ZL/(ZL+Rg);
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['SOL P2 YL=', num2str(round(10*YL*1e3)/10),' mS, PL=',num2str(round(10*PL*1e3)/10), '
mW']);
   case {3,4}
       YL=1/R+YB; ZL=1/YL;
       IL=Vg/(Rg+ZL);
       VL=Vg*ZL/(ZL+Rg);
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['SOL P2 ZL=', num2str(round(10*ZL)/10),' Ohm, PL=',num2str(round(10*PL*1e3)/10), ' mW']);
   case {5,6}
      YL=1/R+YC; ZL=1/YL;
       IL=Vg/(Rg+ZL);
       VL=Vg*ZL/(ZL+Rg);
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['SOL P2 ZL=', num2str(round(10*ZL)/10),' Ohm, PL=',num2str(round(10*PL*1e3)/10), ' mW']);
   case {7,8}
       ZL=R+ZC; YL=1/ZL;
       IL=Vg/(Rg+ZL);
       VL=Vg*ZL/(ZL+Rg);
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['SOL P2 YL=', num2str(round(10*YL*1e3)/10),' mS, PL=',num2str(round(10*PL*1e3)/10), '
mW']);
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```
   case {9,0}
        ZL=R+ZB; YL=1/ZL;
       IL=Vg/(Rg+ZL);
       VL=Vg*ZL/(ZL+Rg);
       PL=real(VL*conj(IL));
       PLctl1=abs(VL)^2*real(YL);
       PLctl2=abs(IL)^2*real(ZL);
       if PL-PLctl1>1e-12 || PL-PLctl2>1e-12
           disp('ERROR')
       end
       disp (['SOL P2 YL=', num2str(round(10*YL*1e3)/10),' mS, PL=',num2str(round(10*PL*1e3)/10), '
mW']);

end
disp(' ')
disp('PROBLEMA 4')
%Datos comunes
Vg=10/sqrt(2);   %Eficaz
Rg=50;

switch switch_cases
   case {1,2}
       t1=0.926e-9; I1=89.44e-3;
       t3=1.426e-9; I3=-89.44e-3;
       T=2*(t3-t1); f=1/T;
       phi_I=2*pi-2*pi*f*t1;
       na=floor(phi_I/2/pi);
       phi_I=phi_I-na*2*pi;
       I=I1/sqrt(2)*exp(1i*phi_I);  %Fasor de amplitud eficaz
       VL=Vg-I*Rg;
       Vp=abs(VL);  %eficaz
       disp (['SOL P3 f=', num2str(round(f/1e6)),' MHz, phi_I=',num2str(round(10*phi_I*180/pi)/10), 'º,
Vp=', num2str(round(10*Vp*sqrt(2))/10),' V pico']);

   case {3,4}
       t4=1.676e-9; I4=0;
       t5=1.926e-9; I5=89.44e-3;
       T=4*(t5-t4); f=1/T;
       Ip=I5/sqrt(2);
       phi_I=2*pi-2*pi*f*t5;
       %na=floor(phi_I/2/pi);
       %phi_I=phi_I-na*2*pi;
       I=Ip*exp(1i*phi_I);  %Fasor de amplitud eficaz
       VL=Vg-I*Rg;
       %Vp=abs(VL);  %eficaz
       phi_V=angle(VL);
       na=floor(phi_V/2/pi);
       phi_V=phi_V-na*2*pi;
       disp (['SOL P3 f=', num2str(round(f/1e6)),' MHz, Ip=', num2str(round(10*Ip*1e3)/10),' mA
eficaces, phi_V=',num2str(round(100*phi_V)/100),' rad'  ]);
   case {5,6}
       t2=1.1760e-9; I2=0;
       t3=1.4260e-9; I3=-89.44e-3;
       T=4*(t3-t2); f=1/T;
       phi_I=pi/2-2*pi*f*t2;
       na=floor(phi_I/2/pi);
       phi_I=phi_I-na*2*pi;
       I=-I3/sqrt(2)*exp(1i*phi_I);  %Fasor de amplitud eficaz
       VL=Vg-I*Rg;
       Vp=abs(VL);  %eficaz
       disp (['SOL P3 f=', num2str(round(f/1e6)),' MHz, phi_I=',num2str(round(100*phi_I)/100), 'rad,
Vp=', num2str(round(10*Vp)/10),' V eficaces']);

   case {7,8}
       t3=1.4260e-9; I3=-89.44e-3;
       t6=2.426e-9; I6=-89.44e-3;
       T=(t6-t3); f=1/T;
       phi_I=pi-2*pi*f*t3;
       na=floor(phi_I/2/pi);
       phi_I=phi_I-na*2*pi;
       I=-I3/sqrt(2)*exp(1i*phi_I);  %Fasor de amplitud eficaz
       VL=Vg-I*Rg;
       Vp=abs(VL);  %eficaz
       disp (['SOL P3 f=', num2str(round(f/1e6)),' MHz, phi_I=',num2str(round(10*phi_I*180/pi)/10), 'º,
Vp=', num2str(round(10*Vp*sqrt(2))/10),' V pico']);

   case {9,0}
       t5=1.926e-9; I5=89.44e-3;
       t6=2.4260e-9; I6=-89.44e-3;
       T=2*(t6-t5); f=1/T;
       phi_I=2*pi-2*pi*f*t5;
```

```
       %na=floor(phi_I/2/pi);
       %phi_I=phi_I-na*2*pi;
       I=I5/sqrt(2)*exp(1i*phi_I);  %Fasor de amplitud eficaz
       Ip=I5/sqrt(2);
       VL=Vg-I*Rg;
       Vp=abs(VL);  %eficaz
       phi_V=angle(VL);
       na=floor(phi_V/2/pi);
       phi_V=phi_V-na*2*pi;
       disp (['SOL P3 f=', num2str(round(f/1e6)),' MHz, Ip=', num2str(round(10*Ip*1e3*sqrt(2))/10),' mA
pico, phi_V=',num2str(round(10*phi_V*180/pi)/10),' º'  ]);

end
disp(' ')
%Problema opcional:
YL=I/VL;
RL=1/real(YL);
BL=imag(YL); CL=BL/2/pi/f;
  disp (['SOL Opcional RL=', num2str(round(RL*10)/10),' Ohm, CL=', num2str(round(CL*1e12*pi)),'/pi
pF']);
  disp('  ')
flag_loop_ON=1;
end
return
```