Scilab Textbook Companion for Power Electronics: Principles & Applications by J. M. Jacob[1]

Created by
Amitdas
B.tech
Others
ISM Dhanbad
College Teacher
Tarun Kumar Das
Cross-Checked by
Chaitanya

July 30, 2019

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Textbook Companion and Scilab codes written in it can be downloaded from the "Textbook Companion Project" section at the website http://scilab.in

Book Description

Title: Power Electronics: Principles & Applications

Author: J. M. Jacob

Publisher: Cengage Learning, New Delhi

Edition: 4

Year: 2009

ISBN: 9788131501184

Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

Chapter 1

Advanced operational amplifier principles

Scilab code Exa 1.1 1

```
1  //example 1.1a
2  clc;funcprot(0);
3  //Initialization of Variable
4  R1=1000;
5  R2=1000;
6  Rl=500//load resistance
7  V=1//input voltage
8  Vo=(R2/(R1+R2))*V;
9  disp(Vo,"open output voltage in Vrms")
10 Rll=1/((1/R2)+(1/Rl))//lower loaded resistance
11 disp(Rll,"resistance lower loaded in ohm:")
12 Vol=(Rll/(R2+Rll))*V;
13 disp(Vol,"loaded output voltag in Vrms")
14 clear()
```

Scilab code Exa 1.2 2

```
1 //example 1.2
2 clc;funcprot(0);
3 //Initialization of Variable
4 Rf=100000//resistance
5 Acl=100//amplifier gain
6 Ri=Rf/(Acl-1);
7 disp(Ri/1000,"input resistance in Kohm")
8 clear()
```

Scilab code Exa 1.3 3

```
1 //example 1.3
2 clc;funcprot(0);
3 //Initialization of Variable
4 Vni=0//non inverting voltage
5 Vinv=0;//inverting voltage
6 Vri1=1;
7 Vri2=15;
8 Ri1=5600//resistance
9 Ri2=470000;
10 Rf=10000//load resistance
11 //calculation
12 Ir1=Vri1/Ri1;
13 disp(Ir1*1e6,"current through Ri1 in microAmp:")
14 Ir2=Vri2/Ri2;
15 disp(Ir2*1e6,"current through Ri2 in microAmp:")
16 Irf=(Vri1/Ri1)+(Vri2/Ri2);
17 disp(Irf*1e6,"current through Rf in microAmp:")
18 Vr=Irf*Rf;
19 disp(Vr,"voltage dropped in V:")
20 Vo1=-Vr;
21 disp(Vo1,"output voltage 1 in V:")
22 Vo=Irf*Rf;
23 disp(Vo,"output voltage in V:")
24 clear()
```

Scilab code Exa 1.4 4

```
1 //example 1.4
2 clc;funcprot(0);
3 //Initialization of Variable
4 Ri1=950;//ohm
5 Ri2=1050;
6 Rf1=105000;//resistance
7 Rf2=95000;
8 Vin=5;//voltage
9 //calculation
10 Vinv=(Rf1/(Rf1+Ri1))*Vin;
11 disp(Vinv,"inverting voltage in V:")
12 Vni=Vinv;
13 disp(Vni,"non inverting voltage in V:")
14 Irf2=(Vin-Vinv)/Ri2;
15 disp(Irf2*1e6,"current through Rf2 in microA:")
16 Iri2=Irf2;
17 disp(Iri2*1e6,"current through Ri2 in microA:")
18 Vrf2=Irf2*Rf2;
19 disp(Vrf2,"voltage dropped in V:")
20 Vo=Vinv-Vrf2;
21 disp(Vo*1000,"output voltage in mV:")
22 clear()
```

Scilab code Exa 1.5 5

```
1 //example 1.5
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vniu1=2.45;//V
```

```
5  Vniu2=2.55;//V
6  Vinvu1=2.45;
7  Vinvu2=2.55;
8  Ri1=9000;//ohm
9  Ri2=1000;//ohm
10 Rf1=1000;
11 Rf2=9000;
12 Rg=200;//load resistance
13 //calculation
14 Iri1=Vniu1/Ri1;
15 disp(Iri1*1e6,"input resistor current in microA:")
16 Irg=(Vniu2-Vniu1)/Rg;
17 disp(Irg*1e6,"input resistor current in microA:")
18 Irf1=Irg-Iri1;
19 disp(Irf1*1e6,"feedback resistor current in microAmp
     :")
20 Vrf1=Irf1*Rf1;
21 disp(Vrf1*1000,"resistor voltage in mV:")
22 Vou1=Vniu1-Vrf1;
23 disp(Vou1,"1st output voltage in V:")
24 Iri2=(Vniu2-Vou1)/Ri2;
25 disp(Iri2*1e6,"input resistor current in microA:")
26 Irf2=Iri2+Irg;
27 disp(Irf2*1e6,"input resistor current in microA:")
28 Vrf2=Irf2*Rf2//feedback resistor voltage
29 disp(Vrf2,"feedback resistor voltage in V:")
30 Vo=Vrf2+Vniu2;
31 disp(Vo,"2nd output voltage in V:")
32 clear()
```

Scilab code Exa 1.6a 6

```
1 //example 1.6
2 clc; funcprot(0);
3 // Initialization of Variable
```

```
Vniu1=0;//V
Vinvu2=0;//V
Vref=2.56;
Rl=10000;//ohm
Rf=39200;//ohm
Ro=10;//resistance
Vdc1=5;
Vdc2=15;
Idc=.5;//current
//calculation
Iu1=(Vref/Rl)*.5;
disp(Iu1*1e6,"input resistor current in microA:")
Irf=Iu1;
disp(Irf*1e6,"feedback resistor current in microA:")
Vrf=Irf*Rf;
disp(Vrf,"feedback resistor voltage in V:")
Vout=Vrf+Vinvu2;
disp(Vout,"output resistor voltage in V:")
Eo=Vout-1.2;
disp(Eo,"output voltage in V:")
Iload=Vdc1/Ro;
disp(Iload,"load current in A:")
Pload=Vdc1^2/Ro;
disp(Pload,"load power in W:")
Plm317=(Vdc2-Vdc1)*Idc;
disp(Plm317,"powerdissipated in LM317 in W:")
```

Scilab code Exa 1.6b 7

```
//example 1.6b
clc; funcprot(0);
// Initialization of Variable
Vin=4;//V
Vs=1.8;//V
Rf=10000;//ohm
```

```
Ri=1100;//ohm
Rl=2;//ohm
Rs=0.1;//ohm
//calculation
Irf=Vin/(Rf+Ri);
disp(Irf*1e6,"input resistor current in microamp:")
Vni=Irf*Ri;
disp(Vni*1000,"inverting voltage 1 & 2 in mV:")
Ir=Vni/Rs;
disp(Ir,"current across Rs in A:")
Ve=Ir*(Rl+Rs);
disp(Ve,"emitter voltage in V:")
Vo=Ve+Vs;
disp(Vo,"output voltage in V:")
clear()
```

Scilab code Exa 1.7 8

```
//example 1.7
clc; funcprot(0);
// Initialization of Variable
Vs=18;//V
Rl=8;//load resistance
Pll=100;//power
//calculation
Vlp=Vs-4;
Vlr=Vlp/(2^.5);
disp(Vlr,"rms voltage in V:")
Pl=(Vlr^2)/Rl;
disp(Pl,"power delivered in W:")
Vl=(Pll*Rl)^.5;
disp(Vl,"load voltage in V:")
clear()
```

Scilab code Exa 1.9 9

```
1  //example 1.9
2  clc; funcprot(0);
3  // Initialization of Variable
4  Vp=6;//V
5  Ra=10;//Kohm
6  Rb=1800;//ohm
7  V=8;
8  //solving for Ir & Vo
9  A=[1 -124.6e-6; 7800 -1];
10 B=[134.6e-6;0];
11 x=inv(A)*B;
12 Vo=x(2,1);
13 disp(Vo,"output voltage in V:")
14 Va=Vo+V;
15 Vb=Vo-V;
16 disp(Va,Vb,"V- & V+ in V:")
17 clear()
```

Scilab code Exa 1.11 10

```
1  //exapple 1.11
2  clc; funcprot(0);
3  // Initialization of Variable
4  Vin=4.5;
5  R1=1100;
6  R2=10000;
7  G1=3.4//gain 1
8  G2=120//gain 2
9  //calculation
10 Ir=Vin/R1;
```

```
11 disp(Ir*1000,"output current in mA:")
12 Vo=Ir*(R1+R2);
13 disp(Vo,"output voltage in V:")
14 Vuo1=Vo/G1;
15 disp(Vuo1,"gain output voltage 1 in V:")
16 Vuo2=Vo/G2;
17 disp(Vuo2,"gain output voltage 2 in V:")
18 clear()
```

Chapter 2

Power electronics circuit layout

Scilab code Exa 2.9 1

```
1 //example 2.9
2 clc; funcprot(0);
3 // Initialization of Variable
4 V=15;//voltage
5 R=4;//resistance
6 Vl=.1;
7 D=8;//duty cycle
8 //calculation
9 Il=V/R;
10 disp(Il,"load current in A:")
11 Rw=Vl/Il//wiring resistance
12 disp(Rw*1000,"wiring resistance in mohm:")
13 Ri=Rw/(2*D);
14 disp(Ri*1e6,"resistance per inch in microohm/inch:")
15 clear()
```

Chapter 3

Power parameter calculation

Scilab code Exa 3.1 1

```
1 //example 3.1
2 clc; funcprot(0);
3 // Initialization of Variable
4 Ip=3;
5 f=150000;
6 t=5e-6;
7 //calculation
8 T=1/f;
9 It=Ip/T;
10 disp(It/1000,"ramp current in kAt/s")
11 I5=It*t;
12 disp(I5,"current at 5 micro sec in A")
13 clear()
```

Scilab code Exa 3.2 2

```
1 //example 3.2
2 clc; funcprot(0);
```

```
3 // Initialization of Variable
4 Ip=2;
5 f=500000;
6 Ir=.3;
7 Cd=.4//duty cycle
8 t1=4e-7;
9 t2=1e-6;
10 //calculation
11 T=1/f;
12 Im=Ip-Ir;
13 disp(It=(Ip-Im)*t1/(Cd*T)+Im,"current in time 0<=t
     <800ns in A")
14 disp(It=0,"current in time 800ns<=t<2 microsec in A"
     )
15 I4=(Ip-Im)*t1/(Cd*T)+Im;
16 disp(I4,"current in time 400ns in A")
17 I1=0;
18 disp(I1,"current in time 1 microsec in A")
19 clear()
```

Scilab code Exa 3.3 3

```
1 //example3.2
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vr=120;
5 pi=3.1428;
6 V=(Vr*2^.5)/pi;
7 disp(V,"average voltage in V")
8 clear()
```

Scilab code Exa 3.4 4

```
1 //example 3.4
2 clc; funcprot(0);
3 // Initialization of Variable
4 f=100000;
5 Cd=.35//duty cycle
6 Ip=3;
7 Ir=.4;
8 //calculation
9 Im=Ip-Ir;
10 T=1/f;
11 I=Cd*((Ip-Im)/2+Im)
12 disp(I,"average current in A")
13 clear()
```

Scilab code Exa 3.5 5

```
1 //example 3.5
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vp=15;
5 Cd=.35;
6 f=100000;
7 V=Vp*Cd^.5;
8 disp(V,"rms voltage in V")
9 clear()
```

Scilab code Exa 3.6 6

```
1 //example 3.6
2 clc; funcprot(0);
3 // Initialization of Variable
4 Ip=3;
5 f=100000;
```

```
I=Ip/3^.5;
disp(I,"rms current in A")
clear()
```

Scilab code Exa 3.7 7

```
//example 3.7
clc; funcprot(0);
// Initialization of Variable
Vp=170;
f=60;
Vr=Vp/2;
disp(Vr,"rms voltage in V")
clear()
```

Scilab code Exa 3.8 8

```
//example 3.8
clc; funcprot(0);
// Initialization of Variable
M=1000;
H=40;
T=30;
E1=.9;
E2=.5;
V=220;
//calculation
W=M*H;
P=(W)/(T*550);
disp(P,"power required in hp")
printf('Pick a 5HP motor')
P1=5;
Pe=P1/E1;
```

```
17 I=(Pe*746)/V;
18 disp(I,"current required in amp")
19 clear()
```

Scilab code Exa 3.9 9

```
1 //example 3.9
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vin=1;
5 Ri=1100;
6 Rf=10000;
7 Rl=8;
8 Vs=18;
9 pi=3.1428;
10 //calculation
11 Ir=Vin/Ri;
12 Vl=Ir*(Ri+Rf);
13 Ip=Vl/Rl;
14 Pl=(Vl*Ip)/2;
15 disp(Pl,"power delivered to the load in Watt:-")
16 Ps=(Vs*Ip)/pi;
17 disp(Ps,"power provided by each supply in Watt:-")
18 clear()
```

Scilab code Exa 3.10 10

```
1 //example 3.10
2 clc; funcprot(0);
3 // Initialization of Variable
4 V=170;
5 R=51;
6 //calculation
```

```
I=V/R;
P=(V*I)/4;
disp(P,"power delivered in Watt:")
clear()
```

Scilab code Exa 3.11 11

```
//example 3.11
clc; funcprot(0);
// Initialization of Variable
V=7.2;
Rq=.2;
Rl=4;
D=.6;
//calculation
Ip=V/(Rq+Rl);
Vl=Ip*Rl;
P=D*Vl*Ip;
disp(P,"power dissipated in watt:")
Vq=Ip*Rq;
Pq=D*Vq*Ip;
disp(Pq,"power dissipated when transistor resistance
    is 0.2 hm in watt:")
clear()
```

Chapter 4

Linear power amplifier integrated circuits

Scilab code Exa 4.1 1

```
1 //example 4.1
2 clc; funcprot(0);
3 // Initialization of Variable
4 Rf=1;
5 Ri=10;
6 Vi=0;
7 Ip=500;
8 ///calculation
9 Vrf=Ip*Rf;
10 disp(Vrf,"output voltage in mV:")
11 clear()
```

Scilab code Exa 4.2 2

```
1 //example 4.2
2 clc; funcprot(0);
```

```
// Initialization of Variable
Vi=300;
P=35;
R=8;
pi=3.1428;
S=10000;
fh=20;
//calculation
Vl=(P*R)^.5;
Vp=Vl*2^.5;
Il=Vl/R;
f=S/(2*pi*Vp);
disp(f,"frequency of OPA548 in KHz")
Ao=Vl/Vi;
G=Ao*fh;
disp(G,"slew rate of OPA548 in Mhz")
printf('the OPA548 can be used')
clear()
```

Scilab code Exa 4.3 3

```
//example 4.3
clc; funcprot(0);
// Initialization of Variable
Rl=10;
V=12;
Vl=5;
//calculation
Pl=Vl^2/Rl;
I=Vl/Rl;
Ps=V*I;
Pic=Ps-Pl;
disp(Pic,"power delivered in watt:")
clear()
```

Scilab code Exa 4.4 4

```
1  //example 4.4
2  clc;funcprot(0);
3  //Initilization of variable
4  Vload=[0.0 0.2 0.4 0.6 0.8 4.8 5.0 5.2 5.4 5.6 5.8
       6.0 6.2 6.4 11.4 11.6 11.8 12.0];
5  Iload=[0.0 0.0 0.0 0.1 0.1 0.5 0.5 0.5 0.5 0.6 0.6
       0.6 0.6 0.6 1.1 1.2 1.2 1.2];
6  Pload=[0.00 0.00 0.02 0.04 0.06 2.30 2.50 2.70 2.92
       3.14 3.36 3.60 3.84 4.10 13.00 13.46 13.92
       14.40];
7  Ps=[0.00 0.24 0.48 0.72 0.96 5.76 6.00 6.24 6.48
       6.72 6.96 7.20 7.44 7.68 13.68 13.92 14.16
       14.40];
8  Pic=[0.00 0.24 0.46 0.68 0.90 3.46 3.50 3.54 3.56
       3.58 3.60 3.60 3.60 3.58 0.68 0.46 0.24 0.00];
9  printf('Vload     Iload     Pload     Ps        Pic'
       );
10 printf('\n');
11 for i=1:18
12     printf(' %.2f',Vload(i));
13     printf('      %.2f',Iload(i));
14     printf('      %.2f',Pload(i));
15     printf('      %.2f',Ps(i));
16     printf('      %.2f',Pic(i));
17     printf('\n')
18 end
19 plot(Vload,Pic);
20 xtitle('load voltage vs IC power','Vload (V)','Pic (
     W)')
21 clear()
```

Scilab code Exa 4.5 5

```
1 //example 4.5
2 clc; funcprot(0);
3 // Initialization of Variable
4 V=12;
5 Vp=5;
6 R=10;
7 pi=3.1428;
8 //calculation
9 Ip=Vp/R;
10 Il=Ip/2^.5;
11 Pl=(Vp*Ip)/2;
12 disp(Pl,"power delivered in watt")
13 Id=Ip/pi;
14 disp(Id*1000,"dc supply current in mA")
15 Pt=2*V*Ip/pi;
16 disp(Pt,"total power in W")
17 Pic=Pt-Pl;
18 disp(Pic,"IC power in W")
19 clear()
```

Scilab code Exa 4.6 6

```
1 //example 4.6
2 clc; funcprot(0);
3 // Initialization of Variable
4 Ts=40;
5 P=2.92;
6 Qj=2.5;
7 Qc=2;
8 Tj=125;
```

```
9  //calculation
10 Qs=(Tj-Ts)/P-Qj-Qc;
11 disp(Qs,"thermal resistance in C/W:")
12 clear()
```

Scilab code Exa 4.7 7

```
1  //example 4.7
2  clc; funcprot(0);
3  // Initialization of Variable
4  V=24;
5  R=10;
6  Qs=4;
7  Tj=125;
8  Ta=40;
9  Qj=2.5;
10 Qc=2;
11 //calculation
12 P=(Tj-Ta)/(Qj+Qc+Qs);
13 disp(P,"power delivered by IC in watt:")
14 Vload=[9.4 9.6];
15 Iload=[.94 .96];
16 Pload=[4.42 4.61];
17 Ps=[14.36 14.67];
18 Pic=[9.94 10.06];
19 printf('Vload     Iload     Pload     Ps
      Pic');
20 printf('\n')
21 for i=1:2
22     printf('%.2f',Vload(i));
23     printf('      %.2f',Iload(i));
24     printf('      %.2f',Pload(i));
25     printf('      %.2f',Ps(i));
26     printf('      %.2f',Pic(i));
27     printf('\n')
```

```
28 end
29 clear()
```

Scilab code Exa 4.8 8

```
1 //example 4.8
2 clc; funcprot(0);
3 // Initialization of Variable
4 Rf=22;
5 Ri=1;
6 Rs=15;
7 I=4.75;
8 Rc=4;
9 Vp=2;
10 Rl=8;
11 Im=4;
12 //calculation
13 Av=1+(Rf/Ri);
14 disp(Av,"gain")
15 Il=(Rs*I)/(Rc+13.75);
16 disp(Il,"limit current in A:")
17 Vo=Vp*Av;
18 disp(Vo,"output voltage in V:")
19 V=Im*Rl;
20 disp(V,"maximum output voltage in V")
21 clear()
```

Scilab code Exa 4.9 9

```
1 //example 4.9
2 clc; funcprot(0);
3 // Initialization of Variable
4 D=8;
```

```
d=1;
I=90;
//calculation
Is=20*log10(d/D);
Ir=I-Is;
disp(Ir,"loudness ofsound in dB")
clear()
```

Scilab code Exa 4.10 10

```
//example 4.10
clc; funcprot(0);
// Initialization of Variable
D=1;
I1=108;
I2=95;
P=1;
//calculation
I=I1-I2;
Pr=P*10^(I/10);
disp(Pr,"power provided in watt:")
clear()
```

Scilab code Exa 4.11 11

```
//example 4.11
clc; funcprot(0);
// Initialization of Variable
P=20;
R=8;
Vi=1.23;
//calculation
V=(P*R)^.5;
```

```
9  disp(V,"output voltage in V")
10 G=V/Vi;
11 disp(G,"gain:")
12 clear()
```

Scilab code Exa 4.13 13

```
1  //example 4.13
2  clc; funcprot(0);
3  // Initialization of Variable
4  R=8//resistance
5  V=5//voltage
6  Tm=150//temperature
7  Ta=50//temperature
8  Qa=107;
9  Qc=37;
10 Ps=299;
11 //calculation
12 Vd=V/2;
13 Vm=V-1;
14 Vp=Vm-Vd;
15 Vr=Vp/2^.5;
16 Pl=1000*Vr^2/R;
17 disp(Pl,"power dissipated in mW:")
18 Pl=140;
19 Pic=Ps-Pl;
20 Q=(Tm-Ta)/Pic;
21 disp(Q*1000,"thermal resistance degree C/W")
22 clear()
```

Scilab code Exa 4.14 14

```
1  //example 4.14
```

```
2  clc; funcprot(0);
3  // Initialization of Variable
4  R=8//resistance
5  V=5//voltage
6  //calculation
7  Vl=V-1;
8  Vp=Vl-1;
9  Vr=Vp/2^.5;
10 P=Vr^2/R;
11 disp(P*1000,"pwer deliverd in mwatt")
12 clear()
```

Scilab code Exa 4.15 15

```
1  //example 4.15
2  clc; funcprot(0);
3  // Initialization of Variable
4  R=8//resistance
5  Ts=35//temperature
6  Ta=150//temperature
7  Vm=42//voltage
8  //calcuation
9  Vp=Vm-5;
10 Vr=Vp/2^.5;
11 Pm=Vr^2/R;
12 disp(Pm,"power delivered in watt:")
13 P=45;
14 Qs=(Ta-Ts)/P-1.2;
15 disp(round(Qs*10)/10,"thermal resistance in degreeC/
     W")
16 clear()
```

Chapter 5

Discrete linear power amplifier

Scilab code Exa 5.1 1

```
1 //example 5.1
2 clc; funcprot(0);
3 clf()
4 //initialization of variable
5 Vth=3.6;
6 Vgs=4;//voltage
7 //volt change beyond 3.6 causes a major increase in
     Id as it is cut off voltage
8 printf('Id=0 from 0 to 2 so not shown in the graph')
9 x=linspace(2,3.6,300);
10 y=(-2.5*(x-3.6))^.5;
11 plot(x,y)
12 xtitle('Vgs vs Id','Vgs','Id');
13 clear()
```

Scilab code Exa 5.2 2

```
1 //example 5.2
```

```
2 clc; funcprot(0);
3 // Initialization of Variable
4 V=4.5;//voltage
5 T=25;//degreeC
6 Id=3.8;
7 disp(Id,"drain current in A:")
8 printf('Vth=4V is assumed')
9 clear()
```

Scilab code Exa 5.3 3

```
1 //example 5.3
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vgs=-5;//voltage
5 printf('MOSFET is IRF530N')
6 Vthl=-4;
7 Vthu=-2;
8 disp(Vthl,"lower limit of Vth in V:")
9 disp(Vthu,"upper limit of Vth in V:")
10 Id=2.3;//current
11 disp(Id,"Id in A:")
12 clear()
```

Scilab code Exa 5.5 4

```
1 //example 5.5
2 clc; funcprot(0);
3 // Initialization of Variable
4 R1=22;//resistance
5 Vg=3.6;//voltage
6 Vd=56;
7 G=.98;//gain
```

```
Vi=40;
Rl=8;//load resistance
Vp=36.5;
pi=3.1428;
//calculation
Vr=Vd-Vg;
Ir=Vr/R1;
R2=Vg/Ir;
disp(R2,"resistance in kohm:")
Va=(R1/(R1+R2))*Vi;
Vl=G*Va;
disp(Vl,"load voltage in V:")
Il=Vp/Rl;
Pl=Vp*4.6/4;
Ps=Vd*4.6/pi;
Pq=Ps-Pl;
disp(Pq,"Pq in watt:")
disp(Ps,"Ps in watt:")
disp(Pl,"Pl in watt:")
```

Scilab code Exa 5.6 5

```
//example 5.6
clc; funcprot(0);
// Initialization of Variable
R1=22;//resistance
V1=56;//voltage
V2=2;//voltage
//calculation
I=(V1-V2)/R1;
disp(I,"current in mA")
R2=V2/I;
disp(R2*1000,"resistance2 in ohm:")
printf('pick R2=R3=820ohm R1=R4=22 kohm')
clear()
```

Scilab code Exa 5.7 6

```
1 //example 5.7
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vi=350;//voltage
5 f=100;//frequency
6 Rf=10000;//resistance
7 Ri=520;
8 //calculation
9 Vp=(1+(Rf/Ri))*Vi*2^.5;
10 disp(Vp/1000,"load voltage in V:")
11 clear()
```

Scilab code Exa 5.8 7

```
1 //example 5.8
2 clc; funcprot(0);
3 // Initialization of Variable
4 P=50;//power
5 Z=4.7//impedence
6 R=4;//resistance
7 Ta=40;//degreeC
8 Tj=140;//degreeC
9 Vd=28;
10 R2=22;
11 pi=3.1428;
12 //calculation
13 Vr=(P*R)^.5;
14 Vp=Vr*2^.5;
15 disp(Vp,"load rms voltage in V:")
```

```
Av=-Vr/1.23;
Rf=-Av*Z;
disp(Rf,"resistance in kohm:")
I=(Vd-2)/R2;
disp(I,"current in mA:")
Vm=.63*Vd;
Ip=Vm/R;
disp(Ip,"load current in A:")
Ps=Vd*Ip/pi;
disp(round(Ps),"supply power in watt:")
Pl=Ip^2/2*R;
disp(round(Pl),"load power in W:")
Pq=round(Ps)-Pl/2;
disp(Pq,"power in W:")
Qs=(Tj-Ta)/Pq-2.1;
disp(Qs,"thermal resistance in degreC/W:")
clear()
```

Scilab code Exa 5.9 8

```
//example 5.8
clc; funcprot(0);
// Initialization of Variable
P=50;//power
Z=4.7//impedence
R=4;//resistance
Ta=40;//degreeC
Tj=140;//degreeC
Vd=28;
R2=22;
pi=3.1428;
//calculation
Vr=(P*R)^.5;
Vp=Vr*2^.5;
disp(Vp,"load rms voltage in V:")
```

```
Av=-Vr/1.23;
Rf=-Av*Z;
disp(Rf,"resistance in kohm:")
I=(Vd-2)/R2;
disp(I,"current in mA:")
Vm=.63*Vd;
Ip=Vm/R;
disp(Ip,"load current in A:")
Ps=Vd*Ip/pi;
disp(round(Ps),"supply power in watt:")
Pl=Ip^2/2*R;
disp(round(Pl),"load power in W:")
Pq=round(Ps)-Pl/2;
disp(Pq,"power in W:")
Qs=(Tj-Ta)/Pq-2.1;
disp(Qs,"thermal resistance in degreC/W:")
clear()
```

Scilab code Exa 5.10 9

```
//example 5.10
clc; funcprot(0);
// Initialization of Variable
G=6.4;//A/V
I=5;//current
Pq=9.8;//W
Tj=140;
Ta=40;
//calculation
R=2/G;
disp(R,"resistance in ohm:")
printf('thus pick a .33ohm rsistance')
R=.33;
Im=I/3;
Vr=Im*R;
```

```
16 disp(Vr,"voltage in V:")
17 P=Vr*Im/4;
18 disp(P,"power in W:")
19 Qs=(Tj-Ta)/Pq-2.1;
20 disp(Qs,"thermal resistance in degreeC/W")
21 clear()
```

Scilab code Exa 5.11 10

```
1 //example 5.11
2 clc; funcprot(0);
3 // Initialization of Variable
4 P=200;//power
5 R=8;//ohm
6 //calculation
7 Il=(P/R)^.5*2^.5;
8 Ilm=1.2*Il;
9 disp(Ilm,"limit level current in A:")
```

Scilab code Exa 5.12 11

```
1 //example 5.12
2 clc; funcprot(0);
3 // Initialization of Variable
4 I=6;//current
5 V=.6;//voltage
6 D=.5;//duty cycle
7 //calculation
8 Rs=V/I;
9 disp(Rs,"resistance in ohm")
10 Pr=D*V*I;
11 disp(Pr,"power in W:")
12 Vp=28;
```

```
13 Pm=D*Vp*I;
14 disp(Pm,"MOSFET power in W")
15 T=40;//temperature
16 Tj=T+Pm*5.1;
17 disp(round(Tj),"temperature in degreeC")
```

Scilab code Exa 5.13 12

```
1 //example 5.13
2 clc; funcprot(0);
3 // Initialization of Variable
4 T=130;//temperature
5 P=19.5;//power
6 //calculation
7 Ts=T-P*2.1;
8 disp(Ts,"maximum safe temperature in degreeC")
9 clear()
```

Scilab code Exa 5.14 13

```
1 //example 5.14
2 clc; funcprot(0);
3 // Initialization of Variable
4 pi=3.1428;
5 V=15.0;//voltage
6 f=300.0;//frequency
7 L=4.7;//inductance
8 Vdc=28;//V
9 //calculation
10 Xl=2*pi*f*L;
11 disp(Xl/1000,"reactance in ohm")
12 Zload=sqroot(8^2+8.9^2);//magnitude of Zload
13 Vload=15.0;//msgnitude of Vload
```

```
Vr=Vload*8/Zload;
disp(Vr,"voltage across resistor in V");
disp("-48 is the angle of the voltage in degrees");
Pr=12.5;
disp(Pr,"power dissipated by load in watts")
I=Vr/8*sqroot(2);
disp(I,"current across the resistamce in A");
Psupply=Vdc*I/pi;
disp(Psupply,"power supply in W");
Pq=Psupply-Pr/2;
disp(Pq,"power dissipated by transistor in watts")
clear()
```

Chapter 6

Power switches

Scilab code Exa 6.1 1

```
1 //example 6.1
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vs=28;//V
5 Vi=5;//V
6 Rl=15;//ohm
7 Vc=.8;//V
8 b=20;
9 //calculation
10 Ic=(Vs-Vc)/Rl;
11 disp(Ic,"collector current in A:")
12 Pl=Ic^2*Rl;
13 disp(Pl,"load power in W:")
14 Pq=Ic*Vc;
15 disp(Pq,"transistor power in W:")
16 Ib=Ic/b*1000;
17 disp(Ib,"least value of base current in mA:")
18 Rb=(Vi-.6)/Ib;
19 disp(Rb*1000,"max. value of base resistance in ohm:"
   )
20 printf('thus pick Rb=33ohm,1W')
```

```
21 clear()
```

Scilab code Exa 6.4 2

```
1  //example 6.4
2  clc; funcprot(0);
3  // Initialization of Variable
4  Vd=28;//V
5  f=100;//frequency
6  I=50;//current
7  //calculation
8  Rl=(Vd-.3)/I;
9  disp(Rl*1000,"load resistance in ohm:")
10 printf('thus pick Rl=560ohm')
11 Rl=560;
12 Vp=2.4;
13 Ib=500;//microAmp
14 Rb=(Vp-.9)/Ib;
15 disp(Rb*1000,"max value of Rb is in kohm:")
16 printf('thus pick Rb=2.2kohm')
17 Vl=Vd-.3;
18 D=.5;//duty cycle
19 Ip=Vl/Rl;
20 disp(Ip*1000,"load current in mA:")
21 Pl=D*Vl*Ip;
22 disp(Pl*1000,"load power in mW:")
23 Pq=D*Ip*.3;
24 disp(Pq*1000,"power delivered in mW:")
```

Scilab code Exa 6.5 3

```
1  //example 6.5
2  clc; funcprot(0);
```

```
3 // Initialization of Variable
4 C=640;//capacitor
5 R1=560;//load resistance
6 R2=3.3;//kohm
7 //calculation
8 t1=2.2*R1*C;
9 disp(t1/1000,"time of rise in ns:")
10 t2=2.2*R2*C;
11 disp(t2/1000,"time of rise in microsec:")
12 clear()
```

Scilab code Exa 6.6 4

```
1 //example 6.6
2 clc; funcprot(0);
3 clf()
4 // Initialization of Variable
5 Vol=0.7;
6 Iol=40.0/1000;//current
7 Epullup=28.0;
8 Rpullup=(Epullup-Vol)/Iol;
9 disp(Rpullup,"resistance in ohm")
10 printf('pick up resistance=680 ohm');
11 Rpullup=680.0;
12 C=640;
13 trise=2.2*Rpullup*C;
14 disp(trise/1000,"rise time in ns");
15 //for plotting
16 x=[0 .1 1.9 4.1 5 5.1 5.3 5.6 6 9.3];
17 y=[27.8 .1 .1 .1 .1 5 13.5 21 27 27.8];
18 plot(x,y);
19 xtitle('Vout vs time','time(mus)','Vout')
20 clear()
```

Scilab code Exa 6.7 5

```
1 //example 6.7
2 clc; funcprot(0);
3 // Initialization of Variable
4 R1=.11;//resistance
5 Vd=28;//voltage
6 R2=6;//ohm
7 D=.4;//duty cycle
8 Q=62;
9 Ro=2.6*R1;
10 disp(Ro,"worstcase resistance in ohm:")
11 Ip=Vd/(R2+Ro);
12 disp(Ip,"load current in A:")
13 Vl=Ip*R2;
14 disp(Vl,"load voltage in V:")
15 Pl=D*Vl*Ip;
16 disp(Pl,"load power in W:")
17 Vq=Ip*Ro;
18 disp(Vq,"drop voltage in V:")
19 Pq=D*Vq*Ip;
20 disp(round(Pq*10)/10,"power in W:")
21 T=40+round(Pq*10)/10*Q;
22 disp(T,"temperature in deg.C")
23 clear()
```

Scilab code Exa 6.8 6

```
1 //example 6.8
2 clc; funcprot(0);
3 // Initialization of Variable
4 L=10;//inductor
```

```
I=4.5;//current
t=300//time
//calculation
V=L*I/t;
disp(V*1000,"voltage in V:")
clear()
```

Scilab code Exa 6.9 7

```
//example 6.9
clc; funcprot(0);
// Initialization of Variable
Rl=12;//load resistance
V1=.8;//voltage
V2=2.4;//voltage
D=.8;//duty cycle
Tj=150;//degreeC
Ta=40;//degreeC
Vd=28;
Vo=.7;
I=40;//mA;
//calculation
k=(Vd-Vo)/I;
disp(round(k*1000),"R1+R2 in ohm:")
printf('pick R1=330ohm & R2=360ohm as they divide Vd
    setting 8V<Vg<18V')
R1=330;
R2=360;
Vn1=28;
disp(Vn1,"node voltage for V1 in V:")
Vn2=.7;
disp(Vn2,"node voltage for V2 in V:")
Vg=R2*Vd/(R1+R2)+Vn2;
disp(Vg,"gate voltage in V:")
Vgs=Vg-Vd;
```

```
26 disp(Vgs,"gate & source diff in V:")
27 Vl=Vd*Rl/(Rl+.57);
28 disp(Vl,"load voltage in V:")
29 Il=Vl/Rl;
30 disp(Il,"load current in A:")
31 Pl=D*Vl*Il;
32 disp(Pl,"load power in W:")
33 Vq=Il*.57;
34 Pq=D*Vq*Il;
35 disp(Pq,"Pq in W:")
36 Q=(Tj-Ta)/Pq-3.7;
37 disp(Q,"thermal resistance in degreeC/W:")
38 clear()
```

Scilab code Exa 6.10 8

```
1 //example 6.10
2 clc; funcprot(0);
3 // Initialization of Variable
4 I=40;//current
5 Q=44;//nC
6 t=Q/I;
7 disp(t,"time in micro s:")
8 clear()
```

Scilab code Exa 6.11 9

```
1 //example 6.11
2 clc; funcprot(0);
3 // Initialization of Variable
4 Rl=15;//load resistance
5 D=.85;//duty cycle
6 Ts=60;//degreeC
```

```
Vd=28;//voltage
R1=.375;
R2=.2;
//calculation
I=Vd/(R1+R2+Rl);
disp(I,"current in A:")
Vl=I*Rl;
disp(Vl,"load voltage in V:")
P=D*Vl*I;
disp(P,"power in W:")
Vh=I*R1;
disp(Vh,"high side voltage in V:")
Ph=D*Vh*I;
disp(Ph,"high side power in W:")
Vl=I*R2;
disp(Vl,"low side voltage in V:")
Pl=D*Vl*I;
disp(Pl,"low side power in W:")
Pic=Ph+Pl;
disp(Pic,"IC power in W:")
Pic=1.56;
Tj=150;
Ta=60;
Q=(Tj-Ta)/Pic-2.2;
disp(Q,"thermal resistance in degreeC/W:")
clear()
```

Chapter 7

Switching power supplies

Scilab code Exa 7.1 1

```
1 //example 7.1
2 clc; funcprot(0);
3 // Initialization of Variable
4 T=20;//time
5 Vp=12;//voltage
6 t=5;
7 //calculation
8 D=t/T;
9 disp(D,"duty cycle:")
10 Vd=(D*Vp);
11 disp(Vd,"average voltage in V:")
12 clear()
```

Scilab code Exa 7.2 2

```
1 //example 7.2
2 clc; funcprot(0);
3 // Initialization of Variable
```

```
Vd=12;//voltage
Vl=5;//load voltage
Rl=10;//load resistance
f=100;//frequency
L=220;//inductor
//calculation
D=Vl/Vd;
disp(round(D*100),"duty cycle in %:")
T=1/f;
disp(T*1000,"time in microsec")
t=D*T;
disp(round(t*10000)/10,"on time in microsec")
Vr=Vd-Vl;
I=Vr*round(t*10000)/10/L;
disp(I*1000,"ripple current in mA:")
Il=Vl/Rl;
disp(Il*1000,"load current in mA:")
Ip=Il+I/2;
disp(Ip*1000,"peak inductor current in mA:")
clear()
```

Scilab code Exa 7.3 3

```
//example 7.3
clc; funcprot(0);
// Initialization of Variable
Id=500;//load current
i=134;//mA
D=.42;//duty cycle
//calculation
Ip=Id+i/2;
Im=Id-i/2;
I1=((D/3)*(Ip^2+Im*Ip+Im^2))^.5;
disp(I1,"rms current in mA:")
printf('by trapezium method')
```

```
13 I2=D^.5*Id;
14 disp(I2,"rms current in mA:")
15 printf('by rectangle method')
16 printf('\n rectangle method gives good result than
      trapezium method')
17 clear()
```

Scilab code Exa 7.4 4

```
1 //example 7.4
2 clc; funcprot(0);
3 // Initialization of Variable
4 Vp=.3;//voltage
5 I=500;//current
6 D=.42;//duty cycle
7 T=150;//temperature
8 R=.6;//ohm
9 //calculation
10 Vq=I*R;
11 disp(Vq/1000,"voltage in V:")
12 Pq=D*Vq*I;
13 disp(Pq/1000,"dissipated power in mW:")
14 clear()
```

Scilab code Exa 7.5 5

```
1 //example 7.5
2 clc; funcprot(0);
3 // Initialization of Variable
4 R=10.0;//resistance
5 V1=5.0;//V
6 V2=12.0;//V
7 Ta=80.0;//degreeC
```

```
Tb=150.0;
f=150.0;//frequency
//calculation
D=V1/V2;
disp(D*100,"duty cycle in %")
T=1/f;
disp(T*1000,"time period in microsec:")
t=D*T;
disp(t*1000,"on time in microsec:")
Id=V1/R;
disp(Id*1000,"load current in mA:")
i=.25*Id;
disp(i*1000,"ripple current in mA:")
Vl=V2-V1;
disp(Vl,"inductor voltage in V:")
L=Vl*t/i;
disp(L*1000,"inductor in microH:")
Ip=Id+i/2;
disp(Ip*1000,"inductor current in mA:")
Ic=Id/2;
disp(Ic*1000,"minimum capacitor current in mA:")
Vc=1.5*V2;
disp(Vc,"minimum capacitor voltage in V:")
K=V1/1.23-1;
disp(K,"Rf/Ri = :")
P=.01*V2+D*Id*1;
disp(P,"power of LM2595 in W:")
Q=(Tb-Ta)/P-2.2;
disp(Q,"thermal resistance in degreeC/W:")
clear()
```

Scilab code Exa 7.6 6

```
//example 7.6
clc; funcprot(0);
```

```
3 // Initialization of Variable
4 V1=12//V
5 V2=22;//V
6 I=.7;//A
7 f=100;//kHz
8 R=.4;//ohm
9 Vd=.5;
10 //calculation
11 Pl=V2*I;
12 disp(Pl,"load power in W:")
13 Ps=Pl/.9;
14 disp(Ps ,"supply power in W:")
15 Id=round(Ps/V1*10)/10;
16 disp(Id,"dc current in A:")
17 i=.25*Id;
18 Ip=Id+i/2;
19 disp(Ip,"inductor current in A:")
20 D=round((1-V1/V2)*100)/100;
21 disp(D,"duty cycle :")
22 t=D/f;
23 L=V1*t/i;
24 disp(L*1000,"inductor in microH:")
25 Vp=Id*R;
26 Pq=D*Vp*Id;
27 disp(Pq*1000,"transistor power in mW:")
28 Pd=(1-D)*.5*Id;
29 disp(round(Pd*100)*10,"diode power in mW:")
30 C=Id*t/2/20;
31 disp(C*1e6,"capacitor in microF:")
32 clear()
```

Scilab code Exa 7.7 7

```
1 //example 7.7
2 clc;funcprot(0);
```

```
3 //Initialization of Variable
4 V1=12;//V
5 V2=22;//V
6 I=.7;//A
7 Ta=80;//degreeC
8 Ps=17.1//supply power
9 //calculation
10 K=V2/1.23-1;
11 disp(K,"Rf/Ri=:")
12 printf('pick Rf=22; Ri=1.3;')
13 Id=round(Ps/V1*10)/10;
14 D=round((1-(V1/V2))*100)/100;
15 Ir=D^.5*Id;
16 disp(Id,"rms current in A:")
17 Ps=Ir^2*.15;
18 disp(Ps*1000,"switch power in mW:")
19 Pi=D*Id*V1/50;
20 disp(Pi*1000,"IC power in mW:")
21 P=Ps+Pi;
22 disp(P*1000,"total power in mW:")
23 T=Ta+P*65;
24 disp(T,"IC temperature in degreeC:")
25 clear()
```

Scilab code Exa 7.8 8

```
1 //example 7.8
2 clc;funcprot(0);
3 //Initialization of Variable
4 V1=12;//V
5 V2=5;//V
6 Il=1;//load current
7 T=10;//microsec
8 K=1.25;//Npri/Nsec
9 L=85;//microH
```

```
10 //calculation
11 Vq=V1+V2*K;
12 disp(Vq,"maximum voltage in V:")
13 Vd=V1*K+V2;
14 disp(Vd,"diode voltage in V:")
15 D=round((K*V2)*100/(V1+K*V2))/100;
16 disp(D,"duty cycle:")
17 Po=V2*Il;
18 disp(Po,"power delivered in W:")
19 Pi=round(Po/.09)/10;
20 Id=Pi/V1;
21 disp(Id*1000,"average current in mA:")
22 Im=Id/D;
23 disp(Im,"mid primary current in A:")
24 Ir=(Im*D^.5);
25 disp(Ir*1000,"rms current in mA:")
26 i=V1*D*T/L;
27 disp(i*1000,"ramp current in mA:")
28 IM=Im+.24;
29 disp(IM,"maximum transistor current in A:")
30 Imin=Im-.24;
31 disp(Imin,"minimum transistor current in A:")
32 Ip=K*IM;
33 disp(Ip,"diode peak current in A:")
34 Imid=Il/(1-D);
35 Irms=Imid*(1-D)^.5;
36 disp(Irms,"secondary rms current in A:")
37 C=D*Il*T/20;
38 disp(C*1000,"capacitor in microF:")
39 clear()
```

Chapter 8

Thyristors

Scilab code Exa 8.3 1

```
1 //example 8.3
2 clc;funcprot(0);
3 //Initialization of Variable
4 V=220;//line voltage
5 f=50;//hertz
6 R=80;//load resistance
7 K=50;//di/dt
8 pi=3.1428;
9 //calculation
10 L=V*2^.5/K;
11 disp(L,"inductance in microH:")
12 Z=2*pi*f*L;
13 disp(Z*1e-6,"load impedence at angle 90 degree in
     ohm")
14 clear()
```

Scilab code Exa 8.4 2

```
1  //example 8.4
2  clc;funcprot(0);
3  //Initialization of Variable
4  V=220;//line voltage
5  f=50;//hertz
6  R=80;//load resistance
7  K=75;//dv/dt
8  Vd=400;//DRM voltage
9  pi=3.1428
10 //calculation
11 C=Vd/R/K;
12 disp(C,"minimum value of capacitor in micfoF:")
13 printf('\nchoose C=.1 micoF')
14 C1=.1;
15 Z=1/(2*pi*f*C1);
16 disp(Z*1000,"capacitor impedence at angle -90degree
      in ohm:")
17 Iload=V/1000/(-Z*cos(180*pi/180)+R*round(cos(90*pi
      /180)));
18 disp(Iload,"Load current in mA at an angle 90
      degrees :");
19 Vload=Iload/1000*R;
20 disp(Vload,"Potential drop in V at an angle 90
      degrees :")
21 P=Vload*Iload;
22 disp(int(P),"Power dissipated in mW :")
23 clear()
```

Scilab code Exa 8.5 3

```
1  //example 8.5
2  clc;funcprot(0);
3  //Initialization of Variable
4  V=220;//line voltage
5  f=50;//hertz
```

```
6 R=80;//load resistance
7 I=46;//TSM current
8 //calculation
9 Rs=V*2^.5/(I-V*2^.5/R);
10 disp(Rs,"snubbing resistnce in ohm:")
11 clear()
```

Scilab code Exa 8.6 4

```
1 //example 8.6
2 clc;funcprot(0);
3 //Initialization of Variable
4 R=10;//load
5 V=120;//rms voltage
6 f=60;//hertz
7 T=83.3;//ms
8 t1=15;//ms
9 t2=55;//ms
10 //calculation
11 Tl=1/f;
12 disp(Tl*1000,"line period in ms:")
13 Th=Tl/2;
14 disp(Th*1000,"half-cycle time in ms:")
15 C=round(T/Th/100)*100;
16 disp(C/1000,"cycles:")
17 D1=.2;
18 V1=round(V*D1^.5);
19 disp(V1,"voltage for t1 in V:")
20 P1=V1^2/R;
21 disp(P1,"power for t1 in W:")
22 D2=.7;
23 V2=round(V*D2^.5);
24 disp(V2,"voltage for t2 in V:")
25 P2=V2^2/R;
26 disp(P2,"power for t2 in W:")
```

```
27 clear()
```

Scilab code Exa 8.8 5

```
1  //example 8.8
2  clc;funcprot(0);
3  //Initialization of Variable
4  V=120;//line voltage
5  A=60;//degree
6  D=.35;
7  pi=3.14;
8  //calculation
9  Va=D*V;
10 disp(Va,"average voltage in V:")
11 Vd=V*2^.5*(cos(A*pi/180)+1)/2/pi;
12 disp(round(Vd),"dc voltage in V:")
13 printf('\nthe markers indicae Vp=163V Vave=41')
14 Vr=.9*V;
15 disp(Vr,"full-wave rms voltage in V:")
16 Vrms=V*(2^.5)*(.5*(pi-1.047)+.25*sin(2*A*pi/180))
     ^.5/pi^.5;
17 disp(Vrms,"rms voltage in V:")
18 printf('\nthe markers indicate Vp=169V Vave=106V')
19 clear()
```

Scilab code Exa 8.9 6

```
1  //example 8.9
2  clc;funcprot(0);
3  //Initialization of Variable
4  V=220;//line voltage
5  P=1.3;//kW
6  R=15;//ohm
```

```
pi=3.1428;
//calculation
Vr=round((P*1000*R)^.5);
disp(Vr,"rms voltage in V:")
D=Vr/V;
Vr=V*2^.5*(.5*(pi-1.710)+sin(196*pi/180)/4)^.5/pi
   ^.5;
disp(Vr,"double checked value of rms voltage in V:")
clear()
```

Chapter 9

Power conversion and motor drive applicaions

Scilab code Exa 9.1 1

```
1 //example 9.1
2 clc;funcprot(0);
3 //Initialization of Variable
4 V=28;//V
5 C=4700;//microF
6 R=16;//load
7 f=120;//hertz
8 //calculation
9 Vp=V*2^.5-2;
10 disp(Vp,"peak voltage in V:")
11 Vd=.95*Vp;
12 disp(Vd,"load voltage in V:")
13 Id=Vd/R;
14 v=Id/f/C;
15 disp(v*1e6,"ripple voltage in V:")
16 //approximation
17 Vd=Vp-v*1e6/2;
18 disp(Vd,"approx. load voltage in V:")
19 clear()
```

Scilab code Exa 9.2 2

```
1 //example 9.2
2 clc;funcprot(0);
3 //Initialization of Variable
4 V1=120;//pri voltage
5 V2=28;//sec voltage
6 I=2;//pri current
7 f=60;//Hz
8 Vth=28.8;//open voltage
9 V3=12.1;//pri-short voltage
10 Is=2;//short current at 45 degree
11 pi=3.1428;
12 //calculation
13 Zi=(V2*V3)/V1/Is*cos(45*pi/180);
14 Zj=(V2*V3)/V1/Is*sin(45*pi/180);
15 printf('Zth=Zi in %f is',Zi)
16 printf('\n\nZth=Zj in %f is',Zj)
17 L=Zi/(2*pi*f);
18 disp(L*1000,"inductor in mH:")
19 clear()
```

Scilab code Exa 9.4 3

```
1 //example 9.4
2 clc;funcprot(0);
3 //Initialization of Variable
4 I1=1.8;//current
5 R=16;//resistance
6 I2=5.7;//A
7 V=28.8;//Voltage
```

```
8 //calculation
9 P=I1^2*R;
10 S=I2*V;
11 Pf=P/S;
12 disp(Pf,"power factor:")
13 clear()
```

Scilab code Exa 9.5 4

```
1 //example 9.5
2 clc;funcprot(0);
3 //Initialization of Variable
4 I=22.6;//current
5 V=120;//voltage
6 Id=28;//A
7 Vd=280;//V
8 //calculation
9 P=3*I*V;
10 disp(P/1000,"total power in kW:")
11 Pl=Id*Vd;
12 disp(Pl/1000,"load power in kW:")
13 Pf=Pl/P;
14 disp(Pf,"power factor:")
15 clear()
```

Scilab code Exa 9.6 5

```
1 //example 9.6
2 clc;funcprot(0);
3 //Initialization of Variable
4 V=208;//voltage
5 R=100;//load
6 Vd=150;//V
```

```
pi=3.1428;
//calculation
r=Vd/V;
disp(r,"ratio:")
printf('firing angle is 58 degrees');
a=58;//degree
Vd=3*2^.5*208*(cos(pi/3+a*pi/180)-cos(2*pi/3+a*pi
   /180))/pi;
disp(Vd,"dc voltage in V:")
t=a*16.7/360;
disp(t,"time delay in ms:")
clear()
```

Scilab code Exa 9.7 6

```
//example 9.7
clc;funcprot(0);
//Initialization of Variable
P=150;//power
V=8;//voltage
R=.01;//resistance
D=.5;//duty cycle
//calculation
I=P/.9/D/V;
disp(I,"max. current in A:")
Ir=I*D^.5;
Pq=Ir^2*R;
disp(Pq,"dissipated power in W:")
clear()
```

Scilab code Exa 9.8 7

```
//example 9.8
```

```
2 clc;funcprot(0);
3 //Initialization of Variable
4 f1=60;//frequency
5 V=150;//voltage
6 f2=31;//kHz
7 //calculation
8 f3=f1*4;
9 disp(f3*2^7/1000,"pwm fundamental frequency in kHz:"
    )
10 Vo=V*10^(-4.2);
11 disp(Vo*1000,"output voltage in V:")
12 clear()
```

Scilab code Exa 9.9 8

```
1 //example 9.9
2 clc;funcprot(0);
3 //Initialization of Variable
4 V=120;//load voltage
5 f=60;//Hz
6 Vp=200;//V
7 Vd=5;//V
8 pi=3.1428;
9 //calculation
10 Vdc=2*Vp/pi;
11 disp(Vdc,"average voltage in V:")
12 printf('\nVa-d @ 200Vin=4.2V')
13 Va=4.2;
14 printf('\n\npick R1=47kohm')
15 R1=47;
16 I=(Vdc-Va)/R1;
17 disp(I,"current through dividers in mA:")
18 R2=Va/I;
19 disp(R2,"R2 in kohm:")
20 pi=3.1428;
```

```
21 K=1/(1/R1+1/R2);// R1 \\ R2
22 C=1/2/pi/3.8/K;
23 disp(C*1000,"capacitor in microF:")
24 clear()
```