

Scilab Textbook Companion for
Electrical Measurements Measuring
Instruments
by K. Shinghal¹

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May 30, 2014

¹Funded 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: Electrical Measurements Measuring Instruments

Author: K. Shinghal

Publisher: Pragati Prakashan Merruth

Edition: 1

Year: 2002

ISBN: 81-7556-393-1

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.

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Chapter 1

Philosophy of Measurement

Scilab code Exa 1.1 arithmetic mean average deviation standard deviation and probable error

```
1 //Example 1.1://ARITHEMATIC MEAN,AVERAGE DEVIATION ,
  STANDARD DEVIATION AND PROBABLE ERROR
2 clc;
3 clear;
4 T=[99.7,99.8,99.9,100,100.1,100.2,100.3]; //VOLTS
5 f=[2,8,20,40,21,6,3]; //frequency of occurrence
6 q=[T(1)*f(1),T(2)*f(2),T(3)*f(3),T(4)*f(4),T(5)*f(5)
    ,T(6)*f(6),T(7)*f(7)]; //
7 AM=(q(1)+q(2)+q(3)+q(4)+q(5)+q(6)+q(7))/100; //
  arithmetic mean in mm
8 for i= 1:7
9     qb(i)= T(i)-AM;
10 end
11 Q= [qb(1),qb(2),qb(3),qb(4),qb(5),qb(6),qb(7)]; //
12 AV=(-qb(1)*f(1)-qb(2)*f(2)-qb(3)*f(3)-qb(4)*f(4)+qb
    (5)*f(5)+qb(6)*f(6)+qb(7)*f(7))/100; //
13 SD=sqrt(((qb(1)^2*f(1))+(qb(2)^2*f(2))+(qb(3)^2*f(3)
    )+(qb(4)^2*f(4))+(qb(5)^2*f(5))+(qb(6)^2*f(6))+(
    qb(7)^2*f(7)))/100); //standard deviation
14 r1= 0.6745*SD; //PROBABLE ERROR OF ONE READING
```

```
15 disp(AM," arithmetic mean is ,(V)=")
16 disp(AV," average deviation is ,(V)=")
17 disp(SD," standard deviation is ,(V)=")
18 disp(r1," probable error is ,(V)=")
```

Scilab code Exa 1.2 apparent value of resistance and gross error

```
1 //Example 1.2://APPRABET RESISTANCE AND PERCENTAGE
  GROSS ERROR
2 clc;
3 clear;
4 close;
5 disp("when current reading is 5mA")
6 vr=100;//voltmeter reading
7 ir=5;//mA
8 rt=vr/(ir);//in kilo ohms
9 disp(rt,"apparent resistance in kilo ohms is")
10 vm=150;//range of voltmeter
11 s=1;//kilo ohms per volts sensivity
12 rv=s*vm;//kilo ohms
13 rx=((rt*rv)/(rv-rt));//kilo ohms
14 ge=((rx-rt)/rx)*100;//percentage gross error
15 disp(ge,"percentage gross error is")
16 disp("when current reading is 50mA")
17 vr=100;//voltmeter reading
18 ir1=50;//mA
19 rt1=vr/(ir1);//in kilo ohms
20 disp(rt1,"apparent resistance in kilo ohms is")
21 vm=150;//range of voltmeter
22 s=1;//kilo ohms per volts sensivity
23 rv=s*vm;//kilo ohms
24 rx1=((rt1*rv)/(rv-rt1));//kilo ohms
25 ge1=((rx1-rt1)/rx1)*100;//percentage gross error
26 disp(ge1,"percentage gross error is")
```

Scilab code Exa 1.3 limiting error

```
1 //Example 1.3://limiting error
2 clc;
3 clear;
4 close;
5 fs=1.5;//full scale in percentage
6 vr=500;//voltmeter reading
7 ea=(fs/100)*vr;//volts
8 le=150;//limiting error voltage
9 lep=((ea/le)*100);//limiting error
10 disp(lep,"limiting error at 150 V is ,(%)=")
```

Scilab code Exa 1.4 arithmetic mean average deviation standard deviation and variance

```
1 //Example 1.4://ARITHMETIC MEAN,AVERAGE DEVIATION ,
   STANDARD DEVIATION AND PROBABLE ERROR
2 clc;
3 clear;
4 T=[99.7,99.8,100,100.2,100.3];//VOLTS
5 q=[T(1),T(2),T(3),T(4),T(5)];//
6 AM=(q(1)+q(2)+q(3)+q(4)+q(5))/5;//arithmetic mean
   in mm
7 for i= 1:5
8     qb(i)= T(i)-AM;
9 end
10 Q= [qb(1),qb(2),qb(3),qb(4),qb(5)];//
11 AV=(-qb(1)-qb(2)-qb(3)+qb(4)+qb(5))/5;//
12 SD=sqrt(((qb(1)^2)+(qb(2)^2)+(qb(3)^2)+(qb(4)^2)+(qb
   (5)^2))/5);//standard deviation
13 V=SD^2;//
```

```

14 disp(AM," arithmetic mean is , (V)=")
15 disp(AV," average deviation is , (V)=")
16 disp(SD," standard deviation is , (V)=")
17 disp(V," Variance is ,(V)=")

```

Scilab code Exa 1.5 power and error

```

1 //Example 1.5:// error
2 clc;
3 clear;
4 close;
5 i=8.2;//in amperes
6 r=20;//ohms
7 p=i^2*r;//watts
8 nd=100;//divisions
9 ra=10;//range in amperes
10 rd1=ra/nd;//reading of one division
11 d=0.5;//divisions
12 per=((d*rd1)/i)*100;//possible ameter rwading error
13 amcr=1;//ammemeter constant error
14 ter=amcr+per;//total ammeter error
15 crr=-0.2;//construction error
16 ep=((2*ter)+crr)/nd)*p;//
17 disp(p," power is ,(W)=")
18 disp(ep," error in power is ,(W)=")

```

Scilab code Exa 1.6 arithmetic mean

```

1 //Example 1.6://ARITHEMATIC MEAN
2 clc;
3 clear;
4 T=[99.7,99.8,99.9,100,100.1,100.2,100.3]; //VOLTS
5 f=[2,8,20,40,21,6,3]; //frequency of occurence

```

```

6 for i=1:7
7     qb(i)=T(i)-T(6);
8 end
9 prdtc=[(qb(1)*f(1))+(qb(2)*f(2))+(qb(3)*f(3))+(qb(4)
    *f(4))+(qb(5)*f(5))+(qb(6)*f(6))+(qb(7)*f(7))]
10 am=T(6)+(prdtc/100); //arithmetic mean
11 disp(am," arithmetic mean is ,(V)=")

```

Scilab code Exa 1.7 limiting error

```

1 //Example 1.7://limiting error
2 clc;
3 clear;
4 close;
5 fse=1; //full scale deflection
6 vr=150; //range in volts
7 ev=(fse/100)*vr; //voltage
8 v1=100; //volts
9 le100=((ev)/v1)*100; //in percentage
10 ve=100; //range in mA
11 ee=(fse/100)*ve; //mA
12 e1=55; //mA
13 le50=((ee/e1)*100); //in percentage
14 ler=le100+le50; //
15 disp(ler," limiting error for power is , (%)=")

```

Scilab code Exa 1.8 volume and error in volume

```

1 //Example 1.8:// error
2 clc;
3 clear;
4 close;
5 fse=1; //full scale deflection

```

```

6 e=0.60; //meters
7 v=(e)^3; //volume in m^3
8 ev=3*fse; //error in volume
9 evv=(ev/100)*v; //
10 disp(v,"volume is ,(m^3)=")
11 disp(ev,"percentage error in volume is ,(%)=")
12 disp(evv,"error in volume is ,(m^3)=")

```

Scilab code Exa 1.9 current and error in current

```

1 //Example 1.9:// error
2 clc;
3 clear;
4 close;
5 v=95; //volts
6 r=40; //ohms
7 i=v/r; //amperes
8 err=-0.2; //error in resistance
9 err1=(err/r)*100; //percentage error
10 evv=0.95; //error in voltage
11 evv1=(evv/v)*100; //percentage error
12 x=evv1-err1; //
13 ei=(x/100)*i; //
14 disp(i,"current in the circuit is ,(A)=")
15 disp(ei,"error in current is ,(A)=")
16 disp(x,"percentage error in current is ,(%)=")

```

Scilab code Exa 1.10 resistance and error

```

1 //Example 1.10://MAGNITUDE AND LIMITING ERROR
2 clc;
3 clear;
4 close;

```

```

5 disp("parralel resistance case")
6 r1=40; //ohms
7 er1=5; //percentage error
8 r2=80; //ohms
9 er2=5; //percentage error
10 r3=50; //ohms
11 er3=5; //percentage error
12 rp=((r1*r2*r3)/(r1*r2+r2*r3+r3*r1)); //ohms
13 Y=(r1*r2+r2*r3+r3*r1); //ohms
14 ex=er1+er2+er3; //percentage error
15 ey1=er1+er2; //
16 ey2=er2+er3; //
17 ey3=er3+er1; //
18 y=((r1*r2*ey1)/Y)+((r2*r3*ey2)/Y)+((r3*r1*ey3)/Y));
    //error
19 mer=(y+ex)*rp; //
20 disp(rp,"magnitude of resistance in ohms is")
21 disp(mer/100,"limiting error in ohms is")
22 disp((y+ex),"percentage error (%)")
23 disp("series resistance case")
24 rs=r1+r2+r3; //ohms
25 er(((r1/rs)*er1)+((r2/rs)*er2)+((r3/rs)*er3)); //
26 mer1=(er/100)*rs; //ohms
27 disp(rs,"magnitude of resistance in ohms is")
28 disp(er,"percentage error (%)")
29 disp(mer1,"limiting error in ohms is")

```

Scilab code Exa 1.11 resistance and error

```

1 //Example 1.11://MAGNITUDE AND LIMITING ERROR
2 clc;
3 clear;
4 close;
5 r1=50; //ohms
6 er1=0.5; //percentage error

```



```

7 r2=100; //ohms
8 er2=0.5; //percentage error
9 r3=75.5; //ohms
10 er3=0.5; //percentage error
11 x=((r2/r1)*r3); //ohms
12 eps=er1+er2; //
13 erpsq=eps-er3; //when error in both (PS) and (Q) is
    positive
14 erpsq1=eps+er3; //when error in (PS) is positive and
    (Q) is negative
15 oer1=(erpsq/100)*x; //ohms
16 oer2=(erpsq1/100)*x; //ohms
17 disp(x,"magintude in ohm is")
18 disp(erpsq,"percentage error when error in both (PS)
    and (Q) is positive (%)")
19 disp(oer1,"error in ohms when error in both (PS) and
    (Q) is positive")
20 disp(erpsq1,"percentage error when error in (PS) is
    positive and (Q) is negative (%) ")
21 disp(oer2,"error in ohms when error in (PS) is
    positive and (Q) is negative")

```

Chapter 2

Analog Measurement of Electrical Quantities

Scilab code Exa 2.1 power and error

```
1 //Example 2.1:// wattmeetr reading and error
2 clc;
3 clear;
4 close;
5 disp("for 1st method")
6 v=50; //volts
7 i=20; //amperes
8 pf=0.8; //power factor
9 pl=v*i*pf; //true power
10 vc=(50*pf)+%i*v*sqrt(1-pf^2); //complex form
11 ic=i+%i*0; //
12 r1=0.01; //ohms
13 vpl=vc+(i*r1); //voltage across pressure coil
14 wrlc1=real(vpl)*real(ic); //
15 er=(wrlc1-pl)/(pl); //
16 disp(wrlc1," wattmeter reading is ,(W)=")
17 disp(er*100,"percentage error is high (%)")
18 disp("for 2nd method")
19 r2=1000; //ohms
```

```

20 ic1=ic+(vc/r2); //
21 wrlc2=real(vc)*real(ic1)+imag(vc)*imag(ic1); //
22 er1=(wrlc2-pl)/(pl); //
23 disp(wrlc2," wattmeter reading ,(W)=")
24 disp(er1*100," percentage error is high (%)")

```

Scilab code Exa 2.2 inductance

```

1 //Example 2.2:// self inductance
2 clc;
3 clear;
4 close;
5 c=20; //pF
6 rs=10000; //ohms
7 l=(c*10^-12)*rs^2; //henry
8 disp(1*10^3," self inductance in mH")

```

Scilab code Exa 2.3 percentage error

```

1 //Example 2.3:// percentage error
2 clc;
3 clear;
4 close;
5 v=100; //volts
6 i=10; //amperes
7 pf=0.45; //power factor
8 tp=v*i*pf; //true power in watts
9 f=50; //Hz
10 l=25; //mH
11 r=4000; //ohms
12 b=atan((2*%pi*f*l*10^-3)/r); //phase angle in radians
13 e=v*i*tan(b)*sqrt(1-pf^2); //
14 per=(e*100)/(tp); //

```

```
15 disp(per," percentage error is (%)")
```

Scilab code Exa 2.4 true power

```
1 //Example 2.4:// true power
2 clc;
3 clear;
4 close;
5 ph=45;//degree
6 th=90;//radians
7 del=-45;//radians
8 f=50;//Hz
9 l=15;//mH
10 r=300;//ohms
11 b=atan((2*pi*f*l*10^-3)/r);//in radians
12 k=((cosd(ph))/(cos(b)*cosd(42)));//
13 nr=20;//nomianl ratio
14 e=-0.3;//
15 er=(e*nr)/100;//
16 ar1=nr-er;//actual ratio
17 nr1=100;//nomianl ratio
18 e1=0.9;//
19 er1=(e1*nr1)/100;//
20 ar2=nr1-er1;//actual ratio
21 p=450;//watts
22 tp=ar1*ar2*k*p;//
23 disp(tp*10^-3,"true power in kW is")
24 //answer is wrong in the textbook
```

Scilab code Exa 2.5 torque

```
1 //Example 2.5:// torque
2 clc;
```

```

3 clear;
4 close;
5 d=2.5; //diameter in cm
6 n=500; //turns
7 b=1.1; //mWb/m^2
8 v=100; //volts
9 pf=0.7; //power factor
10 rp=2000; //ohms
11 x=(%pi*(d*10^-2)^2*n*b*10^-3*v*pf)/(4*rp); //
12 ang1=45; //degree
13 ang2=90; //degree
14 td1=x*sind(ang1); //
15 disp(td1,"torque in Nm when angle is 45 degree")
16 td2=x*sind(ang2); //
17 disp(td2,"torque in Nm when angle is 90 degree")

```

Scilab code Exa 2.6 resistance

```

1 //Example 2.6:// resistance
2 clc;
3 clear;
4 close;
5 la=4.78; //henry
6 ra=298; //ohms
7 lb=3; //henry
8 rb=190; //ohms
9 v=200; //volts
10 r=((la*100*lb*100*%pi^2)-(ra*rb))/(rb+ra); //ohm
11 disp(r,"unknown resistance is ,(ohm)=")
12 //answer is wrong in the textbook

```

Scilab code Exa 2.7 resistance

```

1 //Example 2.7:// resistance
2 clc;
3 clear;
4 close;
5 i=20; // amperes
6 v=100; // volts
7 pf=1; // power factor
8 p=v*i*pf; // watts
9 rp=5500; // ohms
10 th=150; // angle
11 kd=((rp*th)/p); // constant
12 wd=20; // watts per degree
13 rp1=wd*kd; // in ohms
14 adr=rp1-rp; //
15 disp(adr, "addition resistance in ohm is")

```

Scilab code Exa 2.8 parameters

```

1 //Example 2.8:// resistance , impedance , power , power
   factor , voltage and power factor
2 clc;
3 clear;
4 close;
5 v=300; // volts
6 i2=2.5; // amperes
7 r=v/i2; // ohms
8 disp(r, "resistance in ohm is")
9 i3=4; // amperes
10 z1=v/i3; // ohms
11 disp(z1, "load impedance in ohm is")
12 v=300; // volts
13 i2=2.5; // amperes
14 r=v/i2; // ohms
15 i1=5.6; // amperes
16 z=v/i1; // ohms

```

```

17 disp(z,"impedance of combination in ohm is")
18 i3=4; //amperes
19 pl=((i1^2-i2^2-i3^2)*r)/2; //in watts
20 disp(pl,"power absorbed by the load in W is")
21 pl=((i1^2-i2^2-i3^2)*r)/2; //in watts
22 pfl=((i1^2-i2^2-i3^2)/(2*i2*i3)); //power factor
23 disp(pfl,"power factor of the load is")
24 pr=i2^2*r; //in watts
25 tps=pl+pr; //in watts
26 disp(tps,"total power supply is ,(W)=")
27 tps=pl+pr; //in watts
28 tpf=tps/(v*i1); //power factor
29 disp(tpf,"total power factor is")

```

Scilab code Exa 2.9 wattmeter reading

```

1 //Example 2.9:// wattmeter reading
2 clc;
3 clear;
4 close;
5 v=24; //volts
6 r1=6; //ohms
7 i=v/r1; //in amperes
8 t=0;0.005
9 vm=100; //volts
10 t0=0; //
11 t1=(1/100); //
12 f=50; //Hz
13 z=2*%pi*f; //
14 x=integrate('sin(z*t)', 't', t0, (t1/2)); //
15 p=vm*(1/t1)*i*x; //
16 disp(p,"average power to be read by wattmeter is ,(W)
    =")

```

Scilab code Exa 2.10 impedance power and power factor

```
1 //Example 2.10://load impedance and combination
  impedance
2 clc;
3 clear;
4 close;
5
6 v3=80; //volts
7 i=4; //amperes
8 z1=v3/i; //ohms
9 v1=140; //volts
10 z=v1/i; //ohms
11 disp(z1,"load impedance in ohm is")
12 disp(z,"impedance of combination in ohm is")
13 v2=75; //volts (it is given 72 in the textbook)
14 r=v2/i; //
15 pl=((v1^2-v2^2-v3^2)/(2*r)); //watts
16 pr=i^2*r; //watts
17 disp(pl,"power absorbed by the load is ,(W)=")
18 disp(pr,"power absorbed by the non inductive
  resistor is ,(W)=")
19 pfl=((v1^2-v2^2-v3^2)/(2*v2*v3)); //power factor of
  the load
20 tp=pr+pl; //total power in watts
21 pfc=tp/(v1*i); //power factor
22 format('v',5)
23 disp(pfl,"power factor of load is")
24 format('v',4)
25 disp(pfc,"power factor of the whole circuit is")
```

Scilab code Exa 2.11 wattmeter reading


```

1 //Example 2.11:// wattmeters readings
2 clc;
3 clear;
4 close;
5 pf=0.8; //
6 td=(sqrt(1-pf^2))/pf; //
7 sr=300; //kW
8 df=(sr/sqrt(3))*td; //
9 w2=(sr+df)/2; //
10 w1=sr-w2; //
11 disp(round(w1), "wattmeter (W1) reading in kW is")
12 disp(round(w2), "wattmeter (W2) reading in kW is")

```

Scilab code Exa 2.12 power factor and capacitance

```

1 //Example 2.12://power factor and capacitance
2 clc;
3 clear;
4 close;
5 w1=-2000; //watts
6 w2=4000; //watts
7 ph=atand((sqrt(3)*(w2-w1))/(w2+w1)); //in degree
8 pf=cosd(ph); //
9 disp(pf, "power factor of the system is")
10 w=w1+w2; //total power
11 v=400; //volts
12 vp=(v/sqrt(3)); //phase voltage
13 pp=w/3; //power per phase
14 pi=(pp)/(vp*pf); //phase current
15 pim=vp/pi; //phase impedance
16 rip=pim*pf; //resistance each phase
17 rep=(sqrt(pim^2-rip^2)); //reactance of each phase
18 pfn=0.5; //power factor
19 pimb=rip/pfn; //impedance per phase
20 repn=(sqrt(pimb^2-rip^2)); //reactance per phase

```

```

21 cp=rep-repn; // capacitive reactance
22 f=50; //Hz
23 f=50; //Hz
24 c=((1/(2*pi*f*cp))); //
25 disp(round(c*10^6), "capacitance is ,(micro-F)=")

```

Scilab code Exa 2.13 power factor

```

1 //Example 2.13://power factor and line current
2 clc;
3 clear;
4 close;
5 x=1; //
6 w2=2*x; //
7 w1=x; //
8 ph=atand((sqrt(3)*(w2-w1))/(w2+w1)); //in degree
9 pf=cosd(ph); //power factor
10 disp(pf, "power factor is")
11 w=50; //kW
12 v=400; //volts
13 il=((w/(sqrt(3)*v*pf)))*10^3; //in amperes
14 disp(il, "line current is ,(A)=")

```

Scilab code Exa 2.14 power and power factor

```

1 //Example 2.14://total power and power factor
2 clc;
3 clear;
4 close;
5 disp("when both readings are positive")
6 w2=2300; //watts
7 w1=4600; //watts
8 p1=w2+w1; //

```

```

 9 ph=atand((sqrt(3)*(w2-w1))/(w2+w1)); //in degree
10 pf=cosd(ph); //power factor
11 disp(p1,"power is ,(W)=")
12 disp(pf,"power factor (leading) is")
13 disp("when second readig is negative")
14 w21=-2300; //watts
15 w1=4600; //watts
16 p2=w21+w1; //
17 ph2=atand((sqrt(3)*(w21-w1))/(w21+w1)); //in degree
18 pf1=cosd(ph2); //power factor
19 disp(p2,"power is ,(W)=")
20 disp(pf1,"power factor (leading) is")

```

Scilab code Exa 2.15 load current

```

1 //Example 2.15://load current
2 clc;
3 clear;
4 close;
5 rw=3550; //reading of wattmeter
6 rp=806; //watts
7 ph=atand((sqrt(3)*rp)/rw); //in degree
8 pf=cosd(ph); //power factor
9 v=440; //volts
10 i=((rw)/(sqrt(3)*v*pf)); //amperes
11 disp(round(i),"load current in amperes is")

```

Scilab code Exa 2.16 error

```

1 //Example 2.16:// error
2 clc;
3 clear;
4 close;

```

```

5 d=87; //degree
6 pf=0.5; //
7 n=(1/4)*sind(d-60); //
8 nc=(1/4)*pf*sind(d); //
9 e=((n-nc)/nc)*100; //error
10 disp(-e,"error (slow) in percentage is")

```

Scilab code Exa 2.17 error

```

1 //Example 2.17://error
2 clc;
3 clear;
4 close;
5 i=5; //amperes
6 t0=0; //
7 t1=30/60; //
8 x=integrate('5','t',t0,t1); //
9 e=0.56; //kWh
10 v=(e*10^3)/x; //volts
11 v1=220; //volts
12 ae=v1*i*t1*10^-3; //actual energy
13 e=((e-ae)/ae)*100; //error
14 disp(e,"error (%) is")

```

Scilab code Exa 2.18 time and limits of accuracy

```

1 //Example 2.18://time and error
2 clc;
3 clear;
4 close;
5 nd=500; //dvisions
6 cr=0.1; //dvisions can read
7 re=(cr/nd)*100; //reading error

```

```

 8  ie=0.05; //inherent error
 9  te=re+ie; //total error
10  tea=0.1; //total error allowable
11  per=tea-te; //permissible error
12  cr1=0.01; //seconds
13  ersw=cr1*100; //error in reading stop watch
14  cr2=0.1; //seconds
15  erss=cr2*100; //error in stopping and starting
16  ter=ersw+erss; //total error
17  t=per/ter; //seconds
18  disp(round(1/t), "time duration in seconds is")
19  nd1=500/10; //
20  er1=(cr/nd1)*100; //new reading error
21  ie1=((ie*nd)/nd1); //new inherent error
22  ter1=er1+ie1; //
23  la=ter1+per; //
24  disp(la, "limits of accuracy (%) is")

```

Scilab code Exa 2.19 error

```

1  //Example 2.19:// error
2  clc;
3  clear;
4  close;
5  n=40; //revolutions
6  rc=0.12; //registration constant
7  err=n/rc; //energy recorded in kWh is
8  e2=22000; //volts
9  e1=110; //volts
10 i2=500; //amperes
11 i1=5; //amperes
12 i=5.25; //amperes
13 lv=110; //volts
14 pf=1; //
15 t=61; //seconds

```

```

16 ae=((sqrt(3)*e2*lv*i*i2*pf*t)/(e1*i1*3600))*10^-3; //
    kWh
17 e=((err-ae)/ae)*100; //
18 disp(-e,"error (slow) is (%)")

```

Scilab code Exa 2.20 limit of error

```

1 //Example 2.20://error and limit of error
2 clc;
3 clear;
4 close;
5 format('v',5)
6 mc=1200;//meter constant in rev/kWh
7 n=40;//revolutions
8 err=n/mc;//energy recorded in kWh
9 tp=99.8;//seconds
10 v=240;//volts
11 i=5;//amperes
12 ae=((v*i*tp*10^-3)/3600);//actual energy in kWh
13 e=((err-ae)/ae)*100;//error
14 disp(e,"error (fast) in recording (%)")
15 n=500;//divisions
16 rn=0.1;//dvision reading accuracy
17 per=((rn/n)*100);//possible error
18 ie=0.05;//inherent error
19 per1=((rn/10)/tp)*100;//possible error
20 her=((ie/tp)*100);//human error
21 tpr=per+per1+her+ie;//total possible error
22 li1=e-tpr;//
23 li2=e+tpr;//
24 disp("limit of error in the meter is "+string(li1)+"
    % or "+string(li2)+"% ")

```

Scilab code Exa 2.21 consumer monthly bill and power factor

```
1 //Example 2.21://consumer monthly bill ,power factor
   and average cost per unit
2 clc;
3 clear;
4 close;
5 format('v',9)
6 kwh=125000;//
7 kvarh=100000;//
8 kvah=sqrt(kwh^2+kvarh^2);//kVAh
9 kw=180;//
10 kvar=125;//
11 mkva=sqrt(kw^2+kvar^2);//kVA
12 pkva=15;//rupees
13 pkvah=0.1;//reupees
14 tmb=pkva*mkva+pkvah*kvah;//in Rs
15 disp(tmb,"total monthly bill in Rs")
16 pf=kwh/kvah;//power factor
17 d=30;//days
18 t=24;//hours a day
19 lf=((kwh/(d*t))/kw);//load factor
20 avcp=tmb/kwh;//in paisa
21 disp(pf,"power factor is")
22 disp(lf,"load factor is")
23 disp(avcp*100,"average cost per unit (kWh) in paisa
   is")
24 //total monthly bill and load factor is calculated
   wrong in the book
```

Scilab code Exa 2.22 error

```
1 //Example 2.22://full load sped and error
2 clc;
3 clear;
```

```

4 close;
5 format('v',9)
6 v=220; //volts
7 i=5; //in amperes
8 wrv=((v*i*10^-3)/(3600)); //kWh
9 mc=((3600*10^3)/(v*i)); //rev/kWh
10 ec=((v*i*10^-3)/(3600)); //kWh
11 sfl=mc*ec; //rps
12 n=30; //revolutions
13 hler=n*ec; //kWh
14 t=59.5; //seconds
15 hlf=((i/2)*v*10^-3*t)/(3600); //kWh
16 e=(hler-hlf)/hlf; //
17 disp(mc,"number of revolution per kWh is ,(
    revolutions/kWh)=")
18 disp(sfl,"full load speed r.p.s is")
19 disp(e*100,"error (fast) in percentage is")
20 //numberof revolutions is calculatdaed wrong in the
    textbook

```

Scilab code Exa 2.23 resistance

```

1 //Example 2.23://shunt resistance
2 clc;
3 clear;
4 close;
5 format('v',9)
6 ra=1000; //armature resistance in ohms
7 i=10; //mA
8 ia=500; //micro amperes
9 rsh1=((ra)/((i/(ia*10^-3))-1)); //in ohms
10 i1=75; //mA
11 rsh2=((ra)/((i1/(ia*10^-3))-1)); //in ohms
12 i3=100; //mA
13 ia3=0.4*ia; //micro amperes

```



```

14 rsh3=((ra)/((i3/(ia3*10^-3))-1)); //in ohms
15 disp(rsh1,"shunt resistance when current is 10mA in
    ohm is")
16 disp(rsh2,"shunt resistance when current is 75mA in
    ohm is")
17 disp(rsh3,"shunt resistance when current is 100mA in
    ohm is")

```

Scilab code Exa 2.24 resistance and power

```

1 //Example 2.24://shunt resistance and series
  resistance
2 clc;
3 clear;
4 close;
5 format('v',9)
6 i=125; //amperes
7 ia=25; //armature current in mA
8 ish=i-(ia*10^-3); //amperes
9 ra=3; //ohms
10 rsh=((ia*ra)/ish); //milli ohms
11 disp(rsh,"shunt resistance in milli ohm is")
12 pcs=ish^2*rsh*10^-3; //watts
13 disp(pcs,"power consumption in shunt is ,(W)=")
14 rv=625; //volts
15 rs=((rv-(ra*ia*10^-3))/(ia*10^-3))*10^-3; //killo
    ohms
16 disp(rs,"series resistance in kilo ohm is")
17 pc=(ia*10^-3)^2*rs*10^3; //watts
18 disp(pc,"power consumption in the series resistance
    is ,(W)=")

```

Scilab code Exa 2.25 multiplying power

```

1 //Example 2.25:// multiplying power
2 clc;
3 clear;
4 close;
5 format('v',9)
6 disp("when micro meter resistance is 25 ohm")
7 ra=25; //ohms
8 rsh=5000; //ohms
9 r1=1250; //ohms
10 n=((ra+rsh)/r1); //
11 r2=2500; //ohms
12 n2=((ra+rsh)/r2); //
13 disp(n,"multiplying power for the shunt for a 1250
    ohm is")
14 disp(n2,"multiplying power for the shunt for a 2500
    ohm is")
15 disp("when micro meter resistance is 2500 ohm")
16 ra1=2500; //ohms
17 rsh=5000; //ohms
18 r1=1250; //ohms
19 n1=((ra1+rsh)/r1); //
20 r2=2500; //ohms
21 n3=((ra1+rsh)/r2); //
22 disp(n1,"multiplying power for the shunt for a 1250
    ohm is")
23 disp(n3,"multiplying power for the shunt for a 2500
    ohm is")

```

Scilab code Exa 2.26 resistance

```

1 //Example 2.26:// resistance
2 clc;
3 clear;
4 close;
5 r1=185; //ohm

```

```

6 r2=205; //ohm
7 r3=215; //ohm
8 R31=195; //OHM
9 r4=200; //ohm
10 R=r1+r2+r3+r4+R31; //ohm
11 r5=1100; //ohm
12 R1=(R-r4)+((r5*r4)/(r5+r4)); //
13 v1=85; //V
14 V=(v1*R1)/round(R1-(R-r4)); //V
15 disp(round(V)," voltage is ,(V)=")
16 I=round(V)/R; //A
17 vd4=I*r4; //V
18 x=0.5; // % allowable
19 vd41=(vd4)-(vd4*x)/100; //
20 rv=((vd41*(R-r4)*r4))/((V*r4)-((R*vd41))); //
21 disp(rv*10^-3," resistance is ,(k-ohm)=")
22 //resistance is calculated wrong in the textbook

```

Scilab code Exa 2.27 resistance and sensitivity

```

1 //Example 2.27: Sensitivity
2 clc;
3 clear;
4 close;
5 //given data :
6 I1=0.1; // in mA
7 R1=50; // in ohm
8 I2=10; // in mA
9 I3=10.1; // in mA
10 I4=I2-I1;
11 Rsh=I1*R1/(I3-I1);
12 Im1=Rsh*I4/(R1+Rsh);
13 S1=(I1-Im1)/(I3-I4);
14 disp(S1,"(a). The sensitivity of an instrument ,S1 =
    ")

```

```

15 I5=10; // in mA
16 V=2; // in Volt
17 R=V/(I5*10^-3);
18 disp(R,"(b). The resistance ,R(ohm) = ")
19 // formula : Im=((I3-Im)*(R-V))/R1;
20 Im2=(0.8*I3)-8;
21 Im3=(0.8*I4)-8
22 S2=(Im2-Im3)/(I3-I4);
23 S=S1/S2;
24 disp(S,"The relative sensitivity ,S = ")

```

Scilab code Exa 2.28 design

```

1 //Example 2.28: Error
2 clc;
3 clear;
4 close;
5 //given data :
6 La=90*10^-6; // in micro-H
7 Ra=0.09; // in ohm
8 LsbyRs=La/Ra;
9 I=50; // in A
10 Ia=5; // in A
11 f=50; // in Hz
12 w=2*pi*f;
13 Rs=Ra/9;
14 Ls=LsbyRs*Rs*10^6;
15 disp(Rs,"Shunt resistance ,Rs(ohm) = ")
16 disp(Ls,"Inductance ,Ls(micro-H) = ")
17 Ls1=0; // shunt is non-inductive
18 Ia1=(Rs*I)/sqrt((Ra+Rs)^2+(w^2*La^2));
19 disp(Ia1,"Current ,Ia1(A) = ")
20 Error=((Ia-Ia1)/Ia)*100;
21 disp(Error,"Error ,(%) (low) = ")

```

Scilab code Exa 2.29 area and error

```
1 //Example 2.29 :area and percentage error
2 clc;
3 clear;
4 close;
5 //given data
6 v1=18; //kV
7 c1=60; //pF
8 v2=2; //
9 q=v2*10^3*c1*10^-12; //
10 cs=q/(v1*10^3); //F
11 d=2.5; //cm
12 eo=8.854*10^-12; //
13 a=((cs*d*10^-2)/(eo)); //
14 disp(round(a*10^4), "area is ,(cm^2)=")
15 c2=50; //pf
16 x=c1-c2; //
17 stf=((v2*10^3)^2*x*10^-12); //
18 v=sqrt(stf/(x*10^-12*2))/1000; //kV
19 c3=c2+(x/2); //pf
20 x1=c3/(cs*10^12); //
21 V1=(x1+1)*v //
22 V=10*sqrt(2); //V
23 er=((V-V1)/V1)*100; //
24 disp(er, "error is ,(%)=")
```

Scilab code Exa 2.30 error

```
1 //Example 2.30: % Error
2 clc;
3 clear;
```

```

4 close;
5 //given data :
6 Ra=2; // in ohm
7 Rsh=0.0004; // constant
8 alfa=0.004;
9 t1=288; // in K
10 t2=333; // in K
11 I=100; // in A
12 Rs=50; // in ohm
13 theta=t2-t1;
14 Ra1=Ra+(alfa*Ra*theta);
15 N1=1+(Ra/Rsh);
16 Ia=I/N1;
17 N2=1+(Ra1/Rsh);
18 Ia1=I/N2;
19 epsilon1=(Ia1-Ia)*100/Ia;
20 disp(epsilon1,"The percentage error ,(%) = ")
21 N3=1+((Ra+Rs)/Rsh);
22 Ia2=I*10^3/N3;
23 N4=1+((Ra1+Rs)/Rsh);
24 Ia3=I*10^3/N4;
25 epsilon2=(Ia3-Ia2)*100/Ia2;
26 disp(epsilon2,"The percentage error ,(%) = ")

```

Scilab code Exa 2.31 resistance

```

1 //Example 2.31: Resistance and electromotive
2 clc;
3 clear;
4 close;
5 //given data :
6 i1=20; // in mA
7 i2=400; // in mA
8 i3=i1/i2;
9 K1=i1/i3;

```

```

10 v1=19.5; // in mV
11 v2=23.4; // in mV
12 x1=v1/K1; //
13 y=100; //mV
14 k2=y/i3; //
15 x2=v2/k2; //
16 A=[1 -x1;1 -x2];
17 B=[v1;v2]; //
18 X=A\B; //
19 disp(X(1,1),"electromotive force is ,(mV)=")
20 disp(X(2,1),"resistance is ,(ohm)=")

```

Scilab code Exa 2.32 error

```

1 //Example 2.32: error
2 clc;
3 clear;
4 close;
5 //given data :
6 V=20*10^3; // in V
7 v1=2*10^3; // in V
8 R=10*10^3; // in ohm
9 r=R*v1/V;
10 f=50; // in Hz
11 w=2*%pi*f;
12 C=0.60*10^-6; // in F
13 v=V/((R/r)*sqrt(1+((w^2*C^2*r^2*(R-r)^2)/R^2)));
14 Error=((v1-v)/v1)*100;
15 disp(Error,"Error ,(%) = ")

```

Scilab code Exa 2.33 flux actual ratio and phase angle

```

1 //Example 2.33: Flux , actual ratio and phase angle

```

```

2  clc;
3  clear;
4  close;
5  //given data :
6  I=5; // in A
7  r1=4; // in ohm
8  r2=0.2; // in ohm
9  Es=I*(r1+r2);
10 Ts=160; // in turns
11 F=50; // in Hz
12 fi=Es*10^3/(4.44*Ts*F);
13 disp(fi,"(i). Flux in the core ,(mWb) = ")
14 I0=6; // in A
15 theta1=30; // in degree
16 Ie=I0*cosd(theta1); // in A
17 Im=I0*sind(theta1); // in A
18 del=0;
19 K=Ts+(((Ie*cosd(del))+ (Im*sind(del)))/I);
20 disp(K,"(ii). The actual ratio ,K = ")
21 theta=(180/%pi)*(((Im*cosd(del))- (Ie*sind(del)))/(Ts
    *I));
22 disp(theta,"(iii). The phase angle ,(degree) = ")

```

Scilab code Exa 2.34 error

```

1  //Example 2.34: The ratio error and phase angle
    error
2  clc;
3  clear;
4  close;
5  //given data :
6  I=5; // in A
7  n=1000/5; // normal ratio
8  sin_alfa=0.4;
9  cos_alfa=sqrt(1-sin_alfa^2);

```



```

10 Im=1; // in A
11 I0=Im/cos_alfa;
12 Ie=I0*sin_alfa;
13 del=0;
14 K=n+(((Ie*cosd(del))+ (Im*sind(del)))/I);
15 er=(n-K)*100/K;
16 disp(er,"(a). The ratio error,(%) = ")
17 eph=(180/%pi)*(((Im*cosd(del))- (Ie*sind(del)))/(n*I)
    );
18 x=round(eph); //
19 y=eph-x; //
20 disp("(b). phase angle is "+string(x)+" degree "+
    string(y*60)+" minutes ")

```

Scilab code Exa 2.35 error

```

1 //Example 2.35: The ratio error and phase angle
  error
2 clc;
3 clear;
4 close;
5 //given data :
6 I=5; // in A
7 Kn=1000/I;
8 n=198; // in turns
9 L=12.5; //in VA
10 Zs=L/I^2;
11 f=50; // assume in Hz
12 l=1*10^-3; // in H
13 Re=2*pi*f*l; // in ohm
14 del=asind(Re/Zs);
15 Ie=10; // in A
16 Im=15; // in A
17 K=n+(((Ie*cosd(del))+ (Im*sind(del)))/I);
18 Rerror=(Kn-K)*100/K;

```

```

19 disp(Rerror,"The ratio error ,(%) = ")
20 eph=(180/%pi)*(((Im*cosd(del))-(Ie*sind(del)))/(n*I)
   );
21 disp(eph,"The phase angle ,(degree) = ")

```

Scilab code Exa 2.36 error and load

```

1 //Example 2.36: phase angle error load in VA
2 clc;
3 clear;
4 close;
5 //given data
6 v1=1000; //V
7 v2=100; //V
8 r=v1/v2; //
9 pf=0.4; //
10 sd=pf; //
11 csd=sqrt(1-pf^2); //
12 im=0.02; //A
13 ie=im*(pf/csd); //A
14 xp=65.4; //ohm
15 rp=97.5; //ohm
16 th=((ie*xp)-(im*rp))/(r*v2); //rad
17 thd=th*(180/%pi); //
18 disp("phase angle is "+string(thd*60) +" minutes")
19 Xp=110; //ohm
20 is=(r*((im*rp)-(ie*xp)))/(Xp);
21 va=is*v2; //VA
22 disp(va,"load is ,(VA)=")

```

Scilab code Exa 2.37 flux and current ratio error

```

1 //Example 2.37: flux and current ratio error

```

```

2  clc;
3  clear;
4  close;
5  n1=1000; //A
6  n2=5; //A
7  r=1.6; //ohm
8  kn=n1/n2; //
9  ts=kn; //
10 wt=1.5; // watt
11 es=n2*r; //v
12 f=50; //Hz
13 ph=es/(4.44*f*kn); //m Wb
14 ep=es/kn; //
15 ie=wt/ep; //A
16 cd1=1; //
17 sd=0; //
18 K=((kn+(ie/n2))); //
19 re=((kn-K)/K)*100; //
20 disp(ph*10^3," flux is ,(m-Wb)=")
21 disp(re," ratio error is ,(%)=")

```

Scilab code Exa 2.38 RCF ratio error and phase angle error

```

1  //Example 2.38: RCF ,ratio error and phase angle
    error
2  clc;
3  clear;
4  close;
5  vp=2000; //V
6  n=20; //
7  vs=vp/n; //
8  va1=50; //
9  pfl1=0.6; //lagging
10 is=va1/vs; //A
11 va2=25; //V

```

```

12 is2=va2/vs; //A
13 ie=0; //
14 im=0; //
15 cd1=0.6; //
16 sd1=sqrt(1-cd1^2); //
17 rs1=0.75; //ohm
18 rp1=300; //ohm
19 Rp1=n^2*rs1+rp1; //ohm
20 xs1=1.5; //ohm
21 xp1=600; //ohm
22 Xp1=n^2*xs1+xp1; //ohm
23 vps1=n+((is/n)*(Rp1*cd1+Xp1*sd1))/vs; //
24 RCF1=vps1/n; //
25 er1=((n-vps1)/vps1)*100; // %
26 per1=((is*(Xp1*cd1-Rp1*sd1))/(n^2*vs))*(180/%pi); //
    degree
27 per1a=round(per1); //
28 x1=per1-per1a; //
29 disp(RCF1,"RCF for case (a) is,=")
30 disp(er1,"phase error for case (a) is,(%)=")
31 disp("phase angle error for case (a) is "+string(x1
    *60)+" minutes")
32 cd11=1; //
33 sd11=sqrt(1-cd11^2); //
34 vps2=n+((is/n)*(Rp1*cd11+Xp1*sd11))/vs; //
35 RCF2=vps2/n; //
36 er2=((n-vps2)/vps2)*100; // %
37 per2=((is*(Xp1*cd11-Rp1*sd11))/(n^2*vs))*(180/%pi);
    //degree
38 per1a1=round(per2); //
39 x2=per1-per1a1; //
40 disp(RCF2,"RCF for case (b) is,=")
41 disp(er2,"phase error for case (b) is,(%)=")
42 disp("phase angle error for case (b) is "+string(
    per2*60)+" minutes")
43 cd12=0.6; //
44 sd12=-0.8; //
45 vps3=n+((is/n)*(Rp1*cd12+Xp1*sd12))/vs; //

```

```

46 RCF3=vps3/n; //
47 er3=((n-vps3)/vps3)*100; // %
48 per3=((is*(Xp1*cd12-Rp1*sd12))/(n^2*vs))*(180/%pi);
    // degree
49 per1a1=round(per2); //
50 x2=per1-per1a1; //
51 disp(RCF3,"RCF for case (c) is,=")
52 disp(er3,"phase error for case (c) is ,(%)=")
53 disp("phase angle error for case (c) is " +string(
    per3*60)+" minutes")
54 cd13=0.6; //
55 sd13=0.8; //
56 vps4=n+((is2/n)*(Rp1*cd13+Xp1*sd13))/vs; //
57 RCF4=vps4/n; //
58 er4=((n-vps4)/vps4)*100; // %
59 per4=((is2*(Xp1*cd13-Rp1*sd13))/(n^2*vs))*(180/%pi);
    // degree
60 per1a1=round(per2); //
61 x2=per1-per1a1; //
62 disp(RCF4,"RCF for case (d) is,=")
63 disp(er4,"phase error for case (d) is ,(%)=")
64 disp("phase angle error for case (d) is " +string(
    per4*60)+" minutes")
65 cd14=1; //
66 sd14=0; //
67 vps5=n+((is2/n)*(Rp1*cd14+Xp1*sd14))/vs; //
68 RCF5=vps5/n; //
69 er5=((n-vps5)/vps5)*100; // %
70 per5=((is2*(Xp1*cd14-Rp1*sd14))/(n^2*vs))*(180/%pi);
    // degree
71 per1a1=round(per2); //
72 x2=per1-per1a1; //
73 disp(RCF5,"RCF for case (e) is,=")
74 disp(er5,"phase error for case (e) is ,(%)=")
75 disp("phase angle error for case (e) is " +string(
    per5*60)+" minutes")
76 cd15=0.6; //
77 sd16=-0.8; //

```

```

78 vps6=n+((is2/n)*(Rp1*cd15+Xp1*sd16))/vs; //
79 RCF6=vps6/n; //
80 er6=((n-vps6)/vps6)*100; // %
81 per6=((is2*(Xp1*cd15-Rp1*sd16))/(n^2*vs))*(180/%pi);
    // degree
82 per1a1=round(per2); //
83 x2=per1-per1a1; //
84 disp(RCF6,"RCF for case (f) is,=")
85 disp(er6,"phase error for case (f) is ,(%)=")
86 disp("phase angle error for case (f) is "+string(
    per6*60)+" minutes")

```

Scilab code Exa 2.39 ratio error RCF and phase angle

```

1 //Example 2.39: RCF ,ratio error and phase angle
  error
2 clc;
3 clear;
4 close;
5 vp=1000; //V
6 is=5; //A
7 n=vp/is; //
8 VA=25; //
9 vs=VA/is; //
10 vp=is/n; //V
11 wt=0.25; //W
12 ie=wt/vp; //A
13 im=15; //A
14 xs=1; //ohm
15 rs=5; //ohm
16 dl=atand(xs/rs); //
17 dlr=dl*(%pi/180); //
18 K=n+((ie*cosd(dl)+im*sind(dl))/is); //
19 re=((n-K)/K)*100; // per
20 RCF=K/n; //

```

```

21 eph=(180/%pi)*(((im*cosd(dl))-(ie*sind(dl)))/(n*is))
    ;
22 disp(re,"ratio error is ,(%)=")
23 disp(RCF,"RCF is ,=")
24 disp(eph,"phase angle error is ,(degree)=")

```

Scilab code Exa 2.40 true value of voltage current and power

```

1 //Example 2.40: true value of voltage ,current and
  power
2 clc;
3 clear;
4 close;
5 vs=102; //V
6 is=4; //A
7 ws=375; //W
8 ph=acosd(ws/(is*vs)); //degree
9 ph1=round(ph); //
10 x=ph-ph1; //
11 y=x*60; //
12 angd=y+22+10; //
13 ang=angd/60; //
14 ta=ph1+ang; //
15 a1=2000; //
16 a2=100; //
17 nr=a1/a2; //
18 rcf=0.995; //
19 rcf1=1.005; //
20 avr=rcf*nr; //
21 pv=avr*vs; //
22 acr=rcf1*(a2/nr); //
23 pc=acr*is*is; //A
24 psd=pv*pc*cosd(ta)*10^-3; //
25 disp(pv,"true value of voltage is ,(V)=")
26 disp(pc,"true value of current is ,(A)=")

```

```
27 disp(psd,"true value of power is ,(kW)=")
```

Scilab code Exa 2.41 primary current and phase error

```
1 //Example 2.41:primary current ,phase error
2 clc;
3 clear;
4 close;
5 zs=0.433+%i*0.25; //ohm
6 zs1=0.15+%i*0.0; //ohm
7 zs2=zs+zs1; //ohm
8 zsa=sqrt(real(zs2)^2+imag(zs2)^2); //
9 zsng=atand(imag(zs2)/real(zs2)); //
10 nt=2; //turns
11 l1=8; //
12 l2=4; //
13 ie=l2/nt; //
14 im=l1/nt; //
15 tnt=198; //turns
16 is=5; //A
17 K=((tnt/2)+((ie*cosd(zsng))+(im*sind(zsng))))/is; //
18 ip=K*is; //A
19 th=((im*cosd(zsng))-(ie*sind(zsng)))/((tnt/2)*is); //
20 disp(ip,"primary current is ,(A)=")
21 disp(th,"phase error is ,(radian)=")
```

Scilab code Exa 2.42 resistance

```
1 //Example 2.42: Resistance
2 clc;
3 clear;
4 close;
5 //given data :
```



```

6 f=50; /// in Hz
7 r=2000; // in ohm
8 L=0.5; // in H
9 Zm=sqrt(r^2+(2*%pi*f*L));
10 V=100; // in V
11 im=V/Zm;
12 Rs=(500-(im*Zm))/im;
13 disp(Rs,"Series resistance ,Rs(ohm) = ")
14 //answer is wrong in the textbook

```

Scilab code Exa 2.43 percentage change in current

```

1 //Example 2.43 :percentage change in current
2 clc;
3 clear;
4 close;
5 //given data
6 r=0.5; //kilo ohm
7 r1=1; //kilo ohm
8 z1=((%i*r1*r)/(r1+%i*r)); //kilo-ohm
9 z1m=sqrt(real(z1)^2+imag(z1)^2); //kilo-ohm
10 z2=((%i*r1*r)/(r+%i*r1)); //kilo-ohm
11 z2m=sqrt(real(z1)^2+imag(z1)^2); //kilo-ohm
12 tz=z1m+z2m; //kilo-ohm
13 f=50; //Hz
14 V=1; //V
15 i=V/tz; //A
16 v1=i*z1m*10^-3; //V
17 v2=i*10^-3*z2m; //V
18 df=f-((f*5)/100); //Hz
19 rc1=((r*df)/f); //k-ohm
20 rc2=((r1*df)/f); //k-ohm
21 z1n=((%i*rc1)/(r1+%i*rc1)); //
22 z1nm=sqrt(real(z1n)^2+imag(z1n)^2); //k-ohm
23 z2n=((%i*rc2*r)/(r+%i*rc2)); //

```

```

24 z2nm=sqrt(real(z1n)^2+imag(z1n)^2); //k-ohm
25 znw=z1nm+z2nm; //k-ohm
26 in=V/znw; //
27 disp(in,"current is ,(mA)=")

```

Scilab code Exa 2.44 inductance and frequency

```

1 //Example 2.44 :Inductance
2 clc;
3 clear;
4 close;
5 //given data
6 c=1; //micro-F
7 f1=60; //Hz
8 f=50; //Hz
9 l1=((c*10^6)/(f1^2*(2*pi)^2)); //
10 r1=100; //ohm
11 z1=r1+%i*((2*pi*f*l1)-(1/(2*pi*f*c*10^-6))); //ohm
12 c2=1.5; //micro-F
13 l2=((-imag(z1))+(1/(2*pi*c2)))/100; //H
14 f2=(1/(2*pi))*sqrt(1/(l2*c2*10^-6)); //Hz
15 disp(l2,"inductance is ,(H)=")
16 disp(f2,"frequency is ,(Hz)=")

```

Scilab code Exa 2.45 resistance and error

```

1 //Example 2.45: Resistance and % error
2 clc;
3 clear;
4 close;
5 //given data :
6 i1=.50; // in mA
7 r1=5000; // in ohm

```

```

8 r2=50; // in ohm
9 V=3; // in V
10 I=i1*10^-3/2; // mid scale deflection current in A
11 Rs=(V/I)-(r1+r2);
12 disp(Rs,"(i). The resistance ,Rs(ohm) = ")
13 A=.5/100;
14 In=30/100;
15 Me=A*1000;
16 Fsr=In*1000;
17 P_error=Me*100/Fsr;
18 disp(P_error,"Percentage inaccuracy ,(%) = ")

```

Scilab code Exa 2.46 inductance and capacitance

```

1 //Example 2.46: inductance and capacitance
2 clc;
3 clear;
4 close;
5 //given data :
6 c1=1.5; //micro-farad
7 f=50; //Hz
8 f1=55; //Hz
9 f2=45; //Hz
10 l1=((1/((2*pi*f)^2)*c1*10^-6)); //H
11 v1=1.211*0.428; //V
12 i1=v1/l1; //mA
13 v2=1.211*.441; //V
14 i2=v2/0.95; //mA
15 v=0.527; //V
16 pec=((i1-v)/v)*100; //
17 pec1=((i2-v)/v)*100; //
18 disp(-pec,"percentage change (decrease) in coil-1
    current is ,(%)=")
19 disp(-pec1,"percentage change (decrease) in coil-2
    current is ,(%)=")

```

```
20 x1=((1/(2*pi*f2)^2));//
21 x2=((314*x1)-(0.318*10^-2))/370;//
22 disp(x2*10^6,"capacitance is ,(micro-F)=")
23 l2=x1/(x2);//
24 disp(l2,"inductance is ,(H)=")
```

Chapter 3

Measurement of parameters

Scilab code Exa 3.1 resistance and percentage error

```
1 //Example 3.1: Resistance and percentage error
2 clc;
3 clear;
4 close;
5 //given data :
6 V=3.2; // in V
7 I=0.4; // in A
8 Rv=500; // in ohm
9 Xt=V/(I*(1-(V/(I*Rv))));
10 Xm=V/I;
11 Pe=((Xm-Xt)/Xt)*100;
12 disp(Xt,"(a). True value of unknown resistance ,Xt(
    ohm) = ")
13 disp(Pe,"(b). % error ,(%) =")
14 disp(" i.e." + string(-Pe) + "% 10w")
```

Scilab code Exa 3.2 resistance

```

1 //Example 3.2: Measured value of resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 a=1; // in ohm
7 b=5; // in ohm
8 A=(1/a)+(1/b);
9 r=1/A;
10 I=0.1; // in A
11 V=r*I;
12 Mr=V/I;
13 disp(Mr,"Measured value of resistance ,(ohm) = ")

```

Scilab code Exa 3.3 resistance

```

1 //Example 3.3: Resistor
2 clc;
3 clear;
4 close;
5 //given data :
6 S=0.02; // in ohm
7 Vs=0.98; // in V
8 Vx=0.735; // in V
9 X=(S*Vx)/Vs;
10 disp(X,"Resistance of resistor under test ,X(ohm) = ")

```

Scilab code Exa 3.4 power loss

```

1 //Example 3.4: Resistor ,current and power loss
2 clc;
3 clear;

```

```

4 close;
5 //given data :
6 S=0.1; // in ohm
7 Vs=1.0235; // in V
8 Vr=0.4211; // in V
9 R=(Vr/Vs)*S;
10 disp(R,"Resistance of unknown resistor ,R(ohm) = ")
11 I=Vs/S;
12 disp(I,"Current through the resistor ,I(A) = ")
13 P=I^2*R;
14 disp(P,"Power loss in the unknown resistance ,P(W) =
    ")

```

Scilab code Exa 3.5 error

```

1 //Example 3.5: Magnitude of error
2 clc;
3 clear;
4 close;
5 //given data :
6 p=100.31; // in ohm
7 q=200; // in ohm
8 P=100.24; // in ohm
9 Q=200; // in ohm
10 S=100.03*10^-6; // in ohm
11 r=700*10^-6; // in ohm
12 Y=50; // in micro-ohm
13 X=((P/Q)*S)+(((q*r)/(p+q))*((P/Q)-(p/q))) *10^6;
14 Error=Y-X;
15 disp(Error,"Magnitude of error ,(micro-ohm) = ")

```

Scilab code Exa 3.6 resistance

```

1 //Example 3.6: Unknown resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 p=100.6; // in ohm
7 q=300.25; // in ohm
8 P=100.5; // in ohm
9 Q=300; // in ohm
10 S=0.0045; // in ohm
11 r=0.1; // in ohm
12 X=((P/Q)*S)+(((q*r)/(p+q+r))*((P/Q)-(p/q))))*10^3;
13 disp(X,"Unknown resistance ,X(m-ohm) = ")

```

Scilab code Exa 3.7 resistance

```

1 //Example 3.7: Unknown resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 s=0.5; //Mega ohms
7 g=10; //killo ohms
8 d1=41; //divisions
9 d2=51; //divisions
10 r=((s*10^6)+(g*10^3))*(d1/d2)-(g*10^3); //ohms
11 disp(r*10^-6,"unknown resistance is ,(Mega-ohm)=")

```

Scilab code Exa 3.8 resistance

```

1 //Example 3.8: Unknown resistance
2 clc;
3 clear;

```



```

4 close;
5 //given data :
6 P=100;// in ohm
7 Q=10;// in ohm
8 S=46;// in ohm
9 R=((P/Q)*S);
10 disp(R," Unknown resistance ,R(ohm) = ")

```

Scilab code Exa 3.9 resistance

```

1 //Example 3.9: limiting value of unknown resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 P=1000;// in ohm
7 Q=1000;// in ohm
8 S=3154;// in ohm
9 R=((P/Q)*S);
10 dp=0.05;//percentage error
11 dq=0.05;//percentage error
12 ds=0.1;//percentage error
13 dr=dp+dq+ds;//percentage error
14 x=R+((dr*10)*R)/100;//
15 disp("limiting value of resistance is "+string(R)+"
      "+string(dr)+"% to "+string(round(x))+ " ohm")

```

Scilab code Exa 3.10 resistance

```

1 //Example 3.10: value of unknown resistance
2 clc;
3 clear;
4 close;

```

```

5 ra=1200; //ohms
6 rb=ra/1600; //ohms
7 r1=800*rb; //ohms
8 r2=r1/1.25; //ohms
9 r3=0.5*rb; //ohms
10 rx=((r2/r1)*r3); //ohms
11 disp(rx,"unknown resistance is ,(Ohm)=")

```

Scilab code Exa 3.11 resistance

```

1 //Example 3.11: Unknown resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 AB=25; // in ohm
7 BC=75; // in ohm
8 S=6; // in ohm
9 R=((AB/BC)*S);
10 disp(R," Unknown resistance ,R(ohm) = ")

```

Scilab code Exa 3.12 arm ratio

```

1 //Example 3.12: length
2 clc;
3 clear;
4 close;
5 r=0.0250; //ohms
6 l=100; //cm
7 d=100; //divisions
8 r1=r/l; //ohm/cm
9 p=10; //ohms
10 q=10; //ohms

```

```

11 x=p/q; //
12 r2=1.0125; //ohms
13 r3=1; //ohms
14 l1=((r3+r)-r2)/(2*r1); //cm
15 l2=100-l1; //cm
16 disp("In case 1 balance is obtained at "+string(l1)+
      " and "+string(l2)+" scale divisions")
17 p1=9.95; //ohms
18 q1=10.05; //ohms
19 x1=p1/q1; //
20 r2=1.0125; //ohms
21 r3=1; //ohms
22 l11=((p1*(r3+r))-(q1*r2))/((p1*r1)+(q1*r1)); //cm
23 l21=100-round(l11); //cm
24 disp("In case 2 balance is obtained at "+string(
      round(l11))+ " and "+string(l21)+" cm")

```

Scilab code Exa 3.13 resistance

```

1 //Example 3.13: Insolution resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 V1=125; // in V
7 V2=100; // in V
8 t=25; // in sec
9 C=600*10^-12; // in F
10 R=t*10^-6/(C*log(V1/V2));
11 disp(round(R)," Insolution resistance ,R(M-ohm) = ")

```

Scilab code Exa 3.14 resistance

```

1 //Example 3.14: Insolution resistance of the cable
2 clc;
3 clear;
4 close;
5 y=10; //Mega ohms
6 d=200; //divisioms
7 d1=126; //divisions
8 d2=100; //divisions
9 c=1; //assume
10 t=30; //seconds
11 x=0.4343
12 r=((x*t)/(c*log10(d/d1))); //
13 rd=((x*t)/(c*log10(d/d2))); //
14 x=rd/r; //
15 ro=((y-(10*x))/x); //Mega ohms
16 disp(round(ro),"Insolution resistance ,R(M-ohm) = ")

```

Scilab code Exa 3.15 resistance

```

1 //Example 3.15:High resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 V1=500; // in V
7 V2=300; // in V
8 t=60; // in sec
9 C=2.5*10^-6; // in F
10 R=t*10^-6/(C*log(V1/V2));
11 disp(R,"Unknown resistance ,R(M-ohm) = ")

```

Scilab code Exa 3.16 resistance

```

1 //Example 3.16: Insolution resistance of the cable
2 clc;
3 clear;
4 close;
5 US=2.5; //SHUNT
6 SD=250; //DIVISIONS
7 x=US*SD; //
8 sr=350; //scale readomh
9 sd1=1000; //shunt
10 y=sr*sd1; //
11 r=1; //Mega ohms
12 ro=(y/x)*r; //mega ohms
13 disp(round(ro), "Insolution resistance ,R(M-ohm) = ")

```

Scilab code Exa 3.17 balanced bridge

```

1 //Example 3.17: Bridhe Balanced
2 clc;
3 clear;
4 close;
5 z1m=400; //ohms
6 z1a=50; //degree
7 z2m=200; //ohms
8 z2a=40; //degree
9 z3m=800; //ohms
10 z3a=-50; //degree
11 z4m=400; //ohms
12 z4a=20; //degree
13 x=z1m*z4m; //ohms
14 y=z2m*z3m; //ohms
15 a=z1a+z4a; //degree
16 b=z2a+z3a; //degree
17 disp("As " + string(x) + " = " + string(y) + " (Z1*Z4=Z2*Z3)
      firts condition is satisfied")
18 disp("As " + string(a) + " " + string(b) + " (Sum of

```

angles) second condition is not satisfied (so bridge is not balanced) ")

Scilab code Exa 3.18 impedance

```
1 //Example 3.18: Resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=100; // in ohm
7 R3=32.7; // in ohm
8 R4=100; // in ohm
9 R=1.36; // in ohm
10 L=47.8; // in mH
11 R1=(R2*R3/R4)-R;
12 disp(R1," Resistance ,R1(ohm) = ")
13 L1=(R2/R4)*L;
14 disp(L1," inductance ,L1(mH) = ")
```

Scilab code Exa 3.19 resistance and inductance

```
1 //Example 3.19: Resistance and Inductance
2 clc;
3 clear;
4 close;
5 f=1; //assume
6 r1=25; //ohms
7 i=50; //MH
8 x=r1+%i*(2*%pi*f*(i*10^-3)); //
9 r2=2; //ohms
10 r=real(x)-r2; //ohms
11 l=imag(x)/(2*%pi*f); //henry
```

```
12 disp(r," resistance is ,(ohm)=")
13 disp(1*10^3," inductance is ,(mH)=")
```

Scilab code Exa 3.20 resistance

```
1 //Example 3.20: Resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=600; // in ohm
7 R3=400; // in ohm
8 R4=1000; // in ohm
9 R1=(R2*R3/R4);
10 disp(R1," Unknown resistance ,R1(ohm) = ")
```

Scilab code Exa 3.21 impedance

```
1 //Example 3.21: Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 S=900; // in ohm
7 P=1.5*10^3; // in ohm
8 Q=2*10^3; // in ohm
9 Cs=0.2*10^-6; // in F
10 rx=S*P/Q;
11 disp(rx," Resistance ,rx(ohm) = ")
12 L=P*Cs*S*10^3;
13 disp(L," Inductance ,L(mH) = ")
```

Scilab code Exa 3.22 resistance and inductance

```
1 //Example 3.22:Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 S=2000; // in ohm
7 P=1000; // in ohm
8 Q=S; // in ohm
9 C=1*10^-6; // in F
10 r=200; // in ohm
11 R=P*Q/S;
12 disp(R," Resistance ,R(ohm) = ")
13 L=(C*P/S)*(r*(Q+S)+(Q*S));
14 disp(L," Inductance ,L(H) = ")
```

Scilab code Exa 3.23 resistance and inductance

```
1 //Example 3.23:Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=250; // in ohm
7 R3=100; // in ohm
8 R4=200; // in ohm
9 r1=43.1; // in ohm
10 R1=(R2*R3/R4)-r1;
11 r=229.7; // in ohm
12 C=1*10^-6; // in F
13 disp(R1," Resistance ,R1(ohm) = ")
```



```
14 L1=(C*R3/R4)*(r*(R4+R2)+(R2*R4));
15 disp(L1,"inductance ,L1(H) = ")
```

Scilab code Exa 3.24 inductance and resistance

```
1 //Example 3.24:Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=1000;// in ohm
7 R3=500;// in ohm
8 R4=1000;// in ohm
9 R1=(R2*R3/R4);
10 r=100;// in ohm
11 C=3*10^-6;// in F
12 disp(R1," Resistance ,R1(ohm) = ")
13 L=(C*R2/R4)*(r*(R4+R3)+(R3*R4));
14 disp(L,"inductance ,L(H) = ")
```

Scilab code Exa 3.25 resistance and inductance

```
1 //Example 3.25:Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=1000;// in ohm
7 R3=16800;// in ohm
8 R4=833;// in ohm
9 C4=0.38*10^-6;// in F
10 f=50;// in Hz
11 w=2*%pi*f;
```

```

12 L1=(R2*R3*C4)/(1+w^2*C4^2*R4^2);
13 disp(L1," Inductance ,L1(H) = ")
14 R1=(R2*R3*R4*w^2*C4^2)/(1+w^2*C4^2*R4^2);
15 disp(R1," Resistance ,R1(ohm) = ")

```

Scilab code Exa 3.26 resistance and inductance

```

1 //Example 3.26: Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=2410; // in ohm
7 R3=750; // in ohm
8 R4=64.9; // in ohm
9 C4=0.35*10^-6; // in F
10 f=500; // in Hz
11 w=2*pi*f;
12 L1=(R2*R3*C4)/(1+w^2*C4^2*R4^2);
13 disp(L1," Inductance ,L1(H) = ")
14 R1=(R2*R3*R4*w^2*C4^2)/(1+w^2*C4^2*R4^2);
15 disp(R1," Resistance ,R1(ohm) = ")

```

Scilab code Exa 3.27 resistance and inductance

```

1 //Example 3.27: Resistance and inductance
2 clc;
3 clear;
4 close;
5 //given data :
6 R3=16800; // in ohm
7 R2=1000; // in ohm
8 R4=833; // in ohm

```

```

9 C4=0.38*10^-6; // in F
10 f=50; // in Hz
11 w=2*%pi*f;
12 L1=(R2*R3*C4)/(1+w^2*C4^2*R4^2);
13 disp(L1," Inductance ,L1(H) = ")
14 R1=(R2*R3*R4*w^2*C4^2)/(1+(w^2*C4^2*R4^2));
15 disp(R1," Resistance ,R1(ohm) = ")
16 //resistance is calculated wrong in the textbook

```

Scilab code Exa 3.28 resistance and inductance

```

1 //Example 3.28: Resistance and Inductance
2 clc;
3 clear;
4 close;
5 r3=100; //ohms
6 c4=0.1; //micro-farads
7 r2=834; //ohms
8 c2=0.124; //micro farads
9 la=r2*r3*c4*10^-3; //mH
10 r1=(r3)*(c4/c2); //ohms
11 disp(la," inductance is ,(mH)=")
12 disp(r1," resistance is ,(ohm)=")

```

Scilab code Exa 3.29 capacitance

```

1 //Example 3.29: Phase angle error and Capacitance
2 clc;
3 clear;
4 close;
5 //given data :
6 C1=1*10^-6; // in F
7 R1=1000; // in ohm

```

```

8 R2=1000; // in ohm
9 f=1000; // in Hz
10 r1=10; // in ohm
11 R3=2000; // in ohm
12 R4=2000; // in ohm
13 C2=C1*R1*10^6/R2;
14 w=2*%pi*f;
15 disp(C2,"Unknown capacitance ,C2(micro-F) = ")
16 r2=(R2*(R3+r1)-(R1*R4))/R1;
17 del1=w*r1*C1*(180/%pi);
18 del2=r2*w*C2*10^-6*(180/%pi);
19 disp(del1,"Phase angle error ,del1(degree) = ")
20 disp(del2,"Phase angle error ,del2(degree) = ")

```

Scilab code Exa 3.30 capacitance and loss angle

```

1 //Example 3.30: Series resistance and loss angle
2 clc;
3 clear;
4 close;
5 //given data :
6 R2=100; // in ohm
7 R4=309; // in ohm
8 C3=100*10^-12; // in F
9 C4=0.5*10^-6; // in F
10 f=50; // in Hz
11 w=2*%pi*f;
12 Rs=C4*R2*10^-6/C3;
13 disp(Rs,"Series resistance ,Rs(M-ohm) = ")
14 Cs=R4*C3*10^12/R2;
15 del=atand(w*Cs*Rs*10^-6);
16 disp(Cs,"capacitance is ,(micro-F)=")
17 disp(del,"Loss angle ,del(degree) = ")

```

Scilab code Exa 3.31 capacitance and angle

```
1 //Example 3.31: Capacitance , power loss , loss
   resistance and loss angle
2 clc;
3 clear;
4 close;
5 //given data :
6 r2=1500/%pi; // in ohm
7 r3=120; // in ohm
8 C2=0.95*10^-6; //F
9 C1=50*10^-12; // F
10 Cs=round(C1*r2*10^12/r3);
11 f=50;
12 w=round(2*%pi*f);
13 disp(Cs," Cable caacitance ,Cs(PF) = ")
14 rs=(r3/(w^2*C1*10));
15 disp(rs*10^-6," Parallel loss resistance ,rs (M-ohm) =
   ")
16 del=atand(100*%pi*C2*r2); //
17 disp(del," loss angle is ,(degree)=")
18 v=100; //kV
19 pl=(v*10^3)^2; //
20 disp(pl," power loss is ,=")
```

Scilab code Exa 3.32 resistance

```
1 //Example 3.32: frequency and resistance
2 clc;
3 clear;
4 close;
5 r1=400; //ohms
```

```

6 c1=1; //micro farads
7 r2=1000; //ohms
8 r3=800; //ohms
9 c3=0.5; //micro farads
10 f=((1/((2*%pi)*sqrt(r1*r3*c1*10^-6*c3*10^-6)))); //Hz
11 x=((c3/c1)+(r1/r3)); //
12 r4=r2*x; //ohms
13 disp(round(f)," frequency is ,(Hz)=")
14 disp(r4," resistance is ,(ohm)=")

```

Scilab code Exa 3.33 resistance and frequency

```

1 //Example 3.33: frequency and resistance
2 clc;
3 clear;
4 close;
5 r1=200; //ohms
6 c1=1; //micro farads
7 r3=400; //ohms
8 r4=1000; //ohms
9 c2=2; //micro farads
10 x=((r4/r3)-(c1/c2)); //
11 r2=r1*x; //ohms
12 f=((1/((2*%pi)*sqrt(r1*r2*c1*10^-6*c2*10^-6)))); //Hz
13 disp(r2," resistance is ,(ohm)=")
14 disp(round(f)," frequency is ,(Hz)=")

```

Scilab code Exa 3.34 voltmeter

```

1 //Example 3.34: percentage error and voltmeter
  readings
2 clc;
3 clear;

```

```

4 close;
5 v=180; // volts
6 i=2; // amperes
7 rm2=v/i; //ohms
8 rv=2000; //ohms
9 iv=v/rv; // amperes
10 ir=i-iv; // amperes
11 r=v/ir; //ohms
12 per=((rm2-r)/r)*100; //
13 ra=0.01; //ohms
14 vr=i*(ra+r); // volts
15 disp(per, "percentage error is ,(%)=")
16 disp(vr, "voltmeter reading is ,(V)=")

```

Scilab code Exa 3.35 resistance

```

1 //Example 3.35:unknown resistance
2 clc;
3 clear;
4 close;
5 P=100.24; //ohms
6 Q=200; //ohms
7 S=100.03; //ohms
8 x=(P/Q)*S*10^-6; //ohms
9 q=200; //ohms
10 r=700; //micro ohms
11 p=100.31; //ohms
12 y=((q*r*10^-6)/(p+q+(r*10^-6))); //ohms
13 z=((P/Q)-(p/q)); //ohms
14 R=x+(y*z); //micro ohms
15 disp(R*10^6, "unknown resistance is ,(micro-ohm)=")

```

Scilab code Exa 3.36 sensitivity

```

1 //Example 3.36: deflection of galvanometer and the
   sensivity
2 clc;
3 clear;
4 close;
5 P=1000; //ohms
6 Q=100; //ohms
7 S=200; //ohms
8 R1=((P/Q)*S); //ohms
9 R=2005; //ohms
10 dr=R-R1; //ohms
11 e=5; //volts
12 eo=e*((R/(R+S))-(P/(P+Q))); //volts
13 ro=((R*S)/(R+S))+((P*Q)/(P+Q)); //ohms
14 G=100; //ohms
15 ig=eo/(ro+G); //amperes
16 si=10; //mm/micro-ampere
17 th=si*(ig*10^6); //mm
18 sb=th/dr; //mm/ohm
19 disp(th,"deflection of the galvanometer is ,(mm)=")
20 disp(sb,"sensivity of bridge is ,(mm/ohm)=")

```

Scilab code Exa 3.37 resistance

```

1 //Example 3.37: Insolution resistance of the cable
2 clc;
3 clear;
4 close;
5 v1=200; //volts
6 v2=125; //volts
7 t=30; //seconds
8 cr=t/(log(v1/v2)); //
9 v21=100; //volts
10 cr1=t/(log(v1/v21)); //
11 y=cr1/cr; //

```



```

12 x=10; //mega ohms
13 R=((x/y)-x); //mega ohms
14 disp(R,"resistance is ,(M-ohm)=")

```

Scilab code Exa 3.38 resistance and inductance

```

1 //Example 3.38:resistance and inductance
2 clc;
3 clear;
4 close;
5 r2=400; //ohms
6 r3=400; //ohms
7 r4=400; //ohms
8 r=500; //ohms
9 c=2; //micro farads
10 rX=((r2*r3)/r4); //ohms
11 l=((c*10^-6*r2)/r4)*((r*(r3+r4))+(r3*r4)); //H
12 disp(rX,"resistance is ,(ohm)=")
13 disp(l,"inductance is ,(H)=")

```

Scilab code Exa 3.39 resistance and inductance

```

1 //Example 3.39:resistance and inductance
2 clc;
3 clear;
4 close;
5 r2=1000; //ohms
6 r3=15000; //ohms
7 r4=500; //ohms
8 c4=1.59; //micro farads
9 f=50; //Hz
10 w=2*%pi*f; //

```

```

11 l=((r2*r3*c4*10^-6)/((1+(w^2*(c4*10^-6)^2*r4^2))));
    //H
12 r=((r2*r3*r4*w^2*(c4*10^-6)^2)/((1+(w^2*(c4*10^-6)
    ^2*r4^2)))); //ohms
13 disp(l," inductance is ,(H)=")
14 disp(r," resistance is ,(ohm)=")
15 //resistance is calculated wrong in the textbook

```

Scilab code Exa 3.40 impedance

```

1 //Example 3.40:resistance and capacitance
2 clc;
3 clear;
4 close;
5 r2=1000; //ohms
6 r4=100; //ohms
7 c4=0.1; //micro farads
8 c3=1000; //pF
9 rs=((c4/(c3*10^-6))*r2); //M-ohm
10 cs=((r4/r2)*(c3*10^-6)); //micro farads
11 disp(rs*10^-7," resistance is ,(M-ohm)=")
12 disp(cs*10^6," capacitance is ,(micro-F)")

```

Scilab code Exa 3.41 resistance and capacitance

```

1 //Example 3.41:resistance and capacitance
2 clc;
3 clear;
4 close;
5 r1=140; //ohms
6 c1=0.0115*10^-6; //F
7 r2=1000; //ohms
8 r4=1000; //ohms

```

```

9 w=7500; //
10 x=((1/(w^2*r1*c1))); //
11 c3=c1; //
12 r3=x/c3; //
13 disp(c3*10^6,"capaciatnce is ,(micro-F)=")
14 disp(r3*10^-6,"resistance is ,(M-ohm)=")

```

Scilab code Exa 3.42 limits

```

1 //Example 3.42:resistance
2 clc;
3 clear;
4 close;
5 dp=0.08; // % error
6 ds=0.05; // % error
7 dq=dp; //
8 dx=dp+ds+dq; // % percentage error
9 x=250; //ohms
10 dx1=dx*x; //
11 disp("Upper and lower limits of X are "+string(x+dx1)
    )+" ohm and "+string(x-dx1)+" ohm")

```

Scilab code Exa 3.43 resistance

```

1 //Example 3.43:resistance
2 clc;
3 clear;
4 close;
5 Q=100.5; //ohms
6 M=300; //ohms
7 S=0.0045; //ohms
8 x=(Q/M)*S; //ohms
9 r=0.1; //ohms

```

```

10 m=300.25; //micro ohms
11 q=100.6; //ohms
12 y=((r*m)/(r+m+q)); //ohms
13 z=((Q/M)-(q/m)); //ohms
14 R=x+(y*z); // milli ohms
15 disp(R*10^3,"unknown resistance is ,(milli-ohm)=")

```

Scilab code Exa 3.44 sensitivity

```

1 //Example 3.44:balance current and bridge sensivity
2 clc;
3 clear;
4 close;
5 P=100; //ohms
6 Q=1000; //ohms
7 S=857; //ohms
8 X=((P/Q)*S); //ohms
9 E=1.5; // volts
10 dx=1/X; //
11 rg=50; //ohms
12 a1=((rg+(X*(Q+S))/(X+S))); //ohms
13 dig=((E*S*X*dx)/((X+S)^2*a1)); //
14 D=100; //M-ohm
15 sb=((dig*D*10^6)/dx); //
16 disp(dig*10^6,"balance current is ,(micro-A)=")
17 disp(sb*10^-1,"bridge sensivity is ,(cm-(ohm/ohm))=")
18 //sensivity is calculated wrong in the book

```

Scilab code Exa 3.45 insulation resistance

```

1 //Example 3.45:insulation resistance
2 clc;
3 clear;

```

```

4 close;
5 x=0.4343; //
6 t=60; //seconds
7 e=350; //volts
8 v=150; //volts
9 c=8*10^-4; //micro-F
10 x1=((x*t)/(c*log10(e/v)))*10^-3; //M-ohm
11 l=1000; //m
12 l2=500; //m
13 xo=((x1*10^3*l2)/l); //M-ohm
14 disp(xo*10^-3,"resistance is ,(M-ohm)=")

```

Scilab code Exa 3.46 resistance

```

1 //Example 3.46:insulation resistance
2 clc;
3 clear;
4 close;
5 v=170; //volts
6 e=250; //volts
7 t=20; //seconds
8 cr1=t/(log(e/v)); //
9 v1=110; //volts
10 e=250; //volts
11 t=20; //seconds
12 cr2=t/(log(e/v1)); //
13 x=cr1/cr2; //
14 r1=25; //M-ohm
15 r2=70; //M-ohm
16 y=((r1*r2)/(r1+r2)); //
17 R=((x*r2*(r1*r2))-(r2*r1*r2))/((r2*(r1+r2))-((r1*r2*
    x))); //
18 disp(R,"resistance is ,(M-ohm)=")

```

Scilab code Exa 3.47 insulation resistance

```
1 //Example 3.47: resistance
2 clc;
3 clear;
4 close;
5 em=500; // volts
6 ep=50; // volts
7 en=150; // volts
8 rv=50; //k-ohm
9 rp=((em-ep-en)/en)*rv*10^3; //ohm
10 rn=((em-ep-en)/ep)*rv*10^3; //
11 disp(rp*10^-6,"Rp is ,(M-ohm)=")
12 disp(rn*10^-6,"Rn is ,(M-ohm)=")
```

Scilab code Exa 3.49 reading

```
1 //Example 3.49: readings
2 clc;
3 clear;
4 close;
5 rp=1; //M-ohm
6 rn=2; //M-ohm
7 r=50; // killo ohms
8 x=((rp*10^6)/(r*10^3)); //
9 v=500; // volts
10 ep=(v)/((rn*x+(rn+rp))); // volts
11 en=2*ep; //
12 disp(ep,"Ep is ,(V)=")
13 disp(en,"En is ,(V)=")
```

Scilab code Exa 3.50 resistance and inductance

```
1 //Example 3.50: Resistance and Inductance
2 clc;
3 clear;
4 close;
5 R2=600; //OHMS
6 R4=400; //OHMS
7 R3=1000; //OHMS
8 C3=0.5; //MICRO-f
9 r=((R2*R4)/R3); //ohms
10 l=R2*R4*C3*10^-6; //H
11 disp(r,"resistance is ,(ohm)=")
12 disp(l,"inductance is ,(H)=")
```

Scilab code Exa 3.51 percentage error

```
1 //Example 3.51: Resistance
2 clc;
3 clear;
4 close;
5 p=100; //ohms
6 q=1000; //ohms
7 s=518.8; //ohms
8 ep=0.1; //
9 eq=0.1; //
10 es1=0.05; //
11 es2=0.05; //
12 es3=0.1; //
13 es4=0.5; //
14 tes=0.267; //
15 pes=(tes/s)*100; //
```

```

16 ds=0.008; //ohms
17 pds=(ds/s)*100; //
18 ttos1=pes+pds; //
19 ttos2=-pes+pds; //
20 m1=ep+eq+ttos1; //
21 m2=-ep-eq+ttos2; //
22 disp(m1,"The maximum (+ve) percentage error in X,=")
23 disp(m2,"The maximum (-ve) percentage error in X,=")
24 disp("Therefore limits of percentage error in X is +
      "+string(m1)+" to "+string(m2)+" ")

```

Scilab code Exa 3.52 capacitance and resistance

```

1 //Example 3.52:loss angle
2 clc;
3 clear;
4 close;
5 r2=2000; //ohms
6 r3=2850; //ohms
7 r4=0.4; //ohms
8 c4=0.5; //micro-F
9 R4=4.8; //ohms
10 r1=((r2*(R4+r4))/r3); //ohms
11 c1=((r3*c4)/r2); //micro-F
12 f=450; //Hz
13 w=2*%pi*f; //
14 d=f*c1*10^-6*r1; //
15 ad=atand(d); //
16 x=round(ad); //
17 disp("loss angle is "+string(x)+" degree and "+
      string(round(ad*60))+ " minutes ")

```

Scilab code Exa 3.53 resistance


```

1 //Example 3.53: resistance
2 clc;
3 clear;
4 close;
5 em=500; // volts
6 i1=0.8; //mA
7 r=30; // killo ohms
8 i2=0.4; //mA
9 ep=i1*r; // volts
10 en=i2*r; // volts
11 rv=50; //k-ohm
12 rp=((em-ep-en)/en)*r*10^3; //ohm
13 rn=((em-ep-en)/ep)*r*10^3; //
14 disp(rp*10^-6,"R1 is ,(M-ohm)=")
15 disp(rn*10^-6,"R2 is ,(M-ohm)=")

```

Scilab code Exa 3.54 capacitance and resistance

```

1 //Example 3.54: resistance and capacitance
2 clc;
3 clear;
4 close;
5 r2=100; //ohms
6 r4=1000; //ohms
7 r1=50; //ohms
8 f=50; //Hz
9 l=0.1; //H
10 r3=((r2*r4)/r1)+((r1*r2*r4)/((2*%pi*f)^2*l^2)); //
    ohms
11 c3=r1/((2*%pi*f)^2*l*r3); //F
12 disp(r3,"resistance is ,(ohm)=")
13 disp(c3*10^6,"capacitance is ,(micro-F)=")
14 //resistance is wrong in the textbook

```

Scilab code Exa 3.56 resistance

```
1 //Example 3.54: resistance and inductance
2 clc;
3 clear;
4 close;
5 r2=16800; //ohms
6 r3=950; //ohms
7 r4=1000; //ohms
8 f=50; //Hz
9 c3=1.57; //micro-F
10 x=((r2*r3*r4*(2*%pi*f)^2*(c3*10^-6)^2)); //
11 y=(1+(((2*%pi*f)^2)*(c3*10^-6)^2*r3^2)); //
12 r1=x/y; //ohms
13 l1=((r2*r4*c3*10^-6)/y); //
14 disp(r1,"resistance is ,(ohm)=")
15 disp(l1,"inductance is ,(H)=")
16 //resistance is wrong in the textbook
```

Scilab code Exa 3.57 capacitance and power factor

```
1 //Example 3.57: resistance , capacitance AND POWER
  FACTOR
2 clc;
3 clear;
4 close;
5 f=50; //Hz
6 r2=120; //ohms
7 c3=0.4; //micro-F
8 c4=106; //pF
9 r3=318; //ohms
10 r1=((r2*c3*10^-6)/(c4*10^-12)); //ohms
```

```

11 c1=((c4*10^-12*r3)/r2); //pF
12 pf=((r1)/(sqrt(r1^2+(1/(2*%pi*f*c1)^2)))); //
13 disp(round(r1*10^-3),"resistance is ,(k-ohm)=")
14 disp(round(c1*10^12),"capacitance is ,(p-F)=")
15 disp(pf,"power factor is ,=")

```

Scilab code Exa 3.58 value of X

```

1 //Example 3.58: resistance
2 clc;
3 clear;
4 close;
5 l1=26; //cm
6 l2=24; //cm
7 l1d=25.8; //cm
8 l2d=23.5; //cm
9 s=545; //ohm
10 sg=65; //ohm
11 sd=((s*sg)/(s+sg)); //ohm
12 X=((sd*(l1-l2))-s*(l1d-l2d))/(l1-l2-l1d+l2d); //
13 disp(X,"X is ,=")

```

Scilab code Exa 3.59 capacitance and resistance

```

1 //Example 3.59: capacitance and resistance
2 clc;
3 clear;
4 close;
5 e1=5000; //volts
6 r1=500; //ohm
7 l1=0.18; //H
8 r2=1000; //ohm
9 r4=r2; //ohms

```

```

10 x=(r1/(e1^2*l1)); //
11 y=((r2*r2)/(1+((e1^2)*x^2))); //
12 c3=((l1/y)); //F
13 r3=(x/c3); //
14 disp(c3*10^6," capacitance is ,(micro-F)=")
15 disp(r3," resistance is ,(ohm)=")

```

Scilab code Exa 3.60 capacitance and resistance

```

1 //Example 3.60 capacitance and resistance
2 clc;
3 clear;
4 close;
5 r2=1000; //ohm
6 w=7500; //
7 c4=0.0115; //micro-F
8 r4=140; //ohms
9 r3=1000; //ohms
10 x=(1+(w^2*(c4*10^-6)^2*(r4^2))); //
11 r1=((r2*x)/(r3*r4*w^2*(c4*10^-6)^2)); //ohms
12 c1=((r3/r2)*(c4*10^-6))/x; //F
13 disp(r1*10^-3," resistance is ,(k-ohm)=")
14 disp(c1*10^6," capacitance is ,(micro-F)=")

```

Scilab code Exa 3.61 inductance

```

1 //Example 3.61; resistance and inductance
2 clc;
3 clear;
4 close;
5 p=0; //
6 r2=10; //ohms
7 r4=900; //ohms

```

```

8 c3=0.9; //micro-F
9 c4=0.15; //micro-F
10 r=((r2*c3*10^-6)/(c4*10^-6)); //ohms
11 l=r2*r4*c3*10^-3; //mH
12 disp(r,"resistance is ,(ohm)=")
13 disp(l,"inductance is ,(mH)=")

```

Scilab code Exa 3.62 resistance

```

1 //Example 3.62;resistance
2 clc;
3 clear;
4 close;
5 d2=350; //
6 f2=1000; //Hz
7 s=1; //M-ohm
8 d1=250; //
9 f1=2.5; //Hz
10 X=((d2*f2*s)/(d1*f1)); //M-ohm
11 l=400; //m
12 l1=1000; //m
13 x=(X*l)/l1; //M-ohm
14 disp(x,"resistance is ,(M-ohm)=")

```

Scilab code Exa 3.63 resistance and inductance

```

1 //Example 3.63:resistance and inductance
2 clc;
3 clear;
4 close;
5 r2=50; //ohms
6 r3=100; //ohms
7 r4=100; //ohms

```

```

8 r=2500; //ohms
9 c=1; //micro farads
10 rX=((r2*r3)/r4); //ohms
11 l=((c*10^-6*r2)/r4)*((r*(r3+r4))+(r3*r4)); //H
12 disp(rX,"resistance is ,(ohm)=")
13 disp(l,"inductance is ,(H)=")

```

Scilab code Exa 3.64 permittivity and power factor

```

1 //Example 3.64:permittivity and power factor
2 clc;
3 clear;
4 close;
5 r3=350; //ohms
6 f=50; //Hz
7 r2=250; //ohms
8 c3=0.4; //micro-F
9 c4=100; //pF
10 r1=((r2*c3*10^-6)/(c4*10^-12)); //ohms
11 c1=((c4*10^-12)*(r3/r2)); //F
12 l=5; //mm
13 l1=10; //cm
14 e=((c1*l*10^-3)/((%pi/4)*(l1/100)^2)); //
15 pf=r1*2*%pi*f*c1; //
16 disp(e,"permittivity is ,=")
17 disp(pf,"power factor is ,=")

```

Scilab code Exa 3.65 constant

```

1 //Example 3.65:resistance and capacitance
2 clc;
3 clear;
4 close;

```

```

5 rab=2000; //ohms
6 f=1; //kHz
7 cab=0.047; //micro-farad
8 zab=(1/((1/rab)+(i*2*pi*f*10^3*cab*10^-6))); //
9 rbc=1000; //ohms
10 cbc=0.47; //micro-F
11 zbc=rbc-(i/(2*pi*f*10^3*cbc*10^-6)); //
12 cda=0.5; //micro-F
13 zda=(-i/(2*pi*f*10^3*cda*10^-6)); //
14 zx=(zda*zbc)/zab; //
15 rx=real(zx); //ohms
16 cx=-1/(2*pi*f*10^3*imag(zx)); //
17 disp(round(rx), "resistance is ,(ohm)=")
18 disp(cx*10^6, "capacitance is ,(micro-F)=")

```

Scilab code Exa 3.66.a capacitance

```

1 //Example 3.66.a:capacitance
2 clc;
3 clear;
4 close;
5 zbc=1000; //ohms
6 f=1; //kHz
7 cda=0.2; //micro-F
8 zab=500; //ohms
9 zda=(-i/(2*pi*f*10^3*cda*10^-6)); //
10 zcd=(zbc*zda)/zab; //
11 cx=-1/(2*pi*f*10^3*imag(zcd)); //
12 disp(cx*10^6, "capacitance is ,(micro-F)=")

```

Scilab code Exa 3.66.b voltage

```

1 //Example 3.66.b:voltage

```

```

2  clc;
3  clear;
4  close;
5  zbc=1000; //ohms
6  f=1; //kHz
7  cda=0.2*10^-6; //micro-F
8  zab=500; //ohms
9  zda=(-%i/(2*%pi*f*10^3*cda)); //
10 zcd=(zbc*zda)/zab; //
11 cx=-1/(2*%pi*f*10^3*imag(zcd)); //
12 rba=1002; //ohms
13 v1=10; //volts
14 iab=v1/(rba+zab); //amperes
15 ibc=iab; //amperes
16 ida=v1*%i*2*%pi*f*10^3*((cda*cx)/(cda+cx)); //amperes
17 icd=ida; //amperes
18 vab=(v1*zab)/(rba+zab); //volts
19 vab1=icd/(%i*2*%pi*10^3*cda); //volts
20 vbd=vab1-vab; //volts
21 disp(vbd*10^3,"voltage across the detector is ,(mV)="
      )

```

Scilab code Exa 3.66.c voltage

```

1  //Example 3.66.c:voltage
2  clc;
3  clear;
4  close;
5  zbc=1000; //ohms
6  f=1; //kHz
7  cda=0.2*10^-6; //micro-F
8  zab=500; //ohms
9  zda=(-%i/(2*%pi*f*10^3*cda)); //
10 zcd=(zbc*zda)/zab; //
11 cx=-1/(2*%pi*f*10^3*imag(zcd)); //

```



```

12 rba=1002; //ohms
13 v1=10; //volts
14 iba=v1/(zab-(%i/(2*%pi*10^3*cda))); //
15 vba=zab*iba; //
16 v2=sqrt(real(vba)^2+imag(vba)^2); //volts
17 ibc=v1/(rba-(%i/(2*%pi*10^3*cx))); //
18 vbc=rba*ibc; //
19 v3=sqrt(real(vbc)^2+imag(vbc)^2); //volts
20 vac=v3-v2; //
21 disp(vac*10^3,"voltage across the detector is ,(mV)="
)

```

Scilab code Exa 3.67 frequency and resistance

```

1 //Example 3.67:frequency and resistance
2 clc;
3 clear;
4 close;
5 rab=800; //ohm
6 cab=0.4; //micro-F
7 rbc=500; //ohms
8 cbc=1; //micro-F
9 rcd=1200; //ohm
10 x=cab*10^-6*rab; //
11 y=cbc*10^-6*rbc; //
12 w=sqrt(1/(x*y)); //rad/s
13 f=w/(2*%pi); //
14 zab=(rab/((1+(%i*w*cab*10^-6*rab)))); //ohms
15 zbc=rbc+(1/((1+(%i*w*cbc*10^-6*rbc)))); //ohms
16 zda=(zab*rcd)/zbc; //ohms
17 disp(round(f),"frequency is ,(Hz)=")
18 disp(round(real(zda)),"resistance is ,(ohm)=")

```

Scilab code Exa 3.68.a constant

```
1 //Example 3.68.a:resistance and inductance
2 clc;
3 clear;
4 close;
5 cab=0.01; //micro-F
6 rbc=2.5; //k-ohms
7 cbc=1; //micro-F
8 rda=7.5*10^3; //ohm
9 cda=0.02; //micro-F
10 w=50*10^3; //Hz
11 zab=(-1/(((%i*w*cab*10^-6*1))))); //ohms
12 zbc=rbc*10^3; //ohms
13 zda=rda+(1/(((%i*w*cda*10^-6))))); //ohms
14 zcd=(zbc*zda)/zab; //
15 r=-real(zcd); //ohms
16 l=-imag(zcd)/w; //H
17 disp(round(r),"resistance is ,(ohm)=")
18 disp(l,"inductance is ,(H)=")
```

Scilab code Exa 3.68.b resistance

```
1 //Example 3.68.B:resistance and inductance
2 clc;
3 clear;
4 close;
5 cab=0.01; //micro-F
6 rbc=2.5; //k-ohms
7 cbc=1; //micro-F
8 rda=7.5*10^3; //ohm
9 cda=0.02; //micro-F
10 w=50*10^3; //Hz
11 zab=(-1/(((%i*w*cab*10^-6*1))))); //ohms
12 zbc=rbc*10^3; //ohms
```

```

13 zda1=rda+(1/(((%i*w*cda*10^-6)))); //ohms
14 zda=zda1/(1+(zda1*%i*w*100*10^-12)); //
15 zcd=(zbc*zda)/zab; //
16 r=-real(zcd); //ohms
17 l=-imag(zcd)/w; //H
18 disp((r)," resistance is ,(ohm)=")
19 disp(l," inductance is ,(H)=")

```

Scilab code Exa 3.69.a resistance and capacitance

```

1 //Example 3.69.a:resistance and capacitance
2 clc;
3 clear;
4 close;
5 zab=521; //ohms
6 zbc=1200; //ohms
7 rda=12.1; //ohms
8 f=10; //kHz
9 cda=0.045; //micro-F
10 zda=rda-(%i/(2*%pi*f*10^3*cda*10^-6)); //
11 zcd=(zbc*zda)/zab; //
12 disp(real(zcd)," resistance is ,(ohm)=")
13 c=1/(2*%pi*f*10^3*imag(zcd)); //
14 disp(-c*10^6," capacitance is ,(micro-F)=")

```

Scilab code Exa 3.69.b error

```

1 //Example 3.69.b:resistance and capacitance
2 clc;
3 clear;
4 close;
5 rab=521; //ohms
6 lab=2; //micro-H

```

```

7 cab=550; //pF
8 rbc=1200; //ohms
9 lbc=5; //micro-H
10 cbc=250; //pF
11 rda=12.1; //ohms
12 rda1=1.5; //m-ohms
13 f=10; //kHz
14 cda=0.045; //micro-F
15 zab=1/((1/(rab+(%i*2*pi*f*10^4*lab*10^-6)))+( %i*2*
    %pi*f*10^3*cab*10^-12)); //
16 zbc=1/((1/(rbc+(%i*2*pi*f*10^4*lbc*10^-6)))+( %i*2*
    %pi*f*10^3*cbc*10^-12)); //
17 zda=rda+((1/((1/rda1*10^-6)+( %i*2*pi*f*10^3*cda
    *10^-6))))); //; //
18 zcd=(zbc*zda)/zab; //
19 zab1=521; //ohms
20 zbc1=1200; //ohms
21 rda1=12.1; //ohms
22 f1=10; //kHz
23 cda1=0.045; //micro-F
24 zda1=rda1-(%i/(2*pi*f1*10^3*cda1*10^-6)); //
25 zcd1=(zbc1*zda1)/zab1; //
26 c1=1/(2*pi*f*10^3*imag(zcd1)); //
27 c=1/(2*pi*f*10^3*imag(zcd)); //
28 per=((real(zcd1)-real(zcd))/real(zcd))*100; //
29 pec=((imag(zcd1)-imag(zcd))/imag(zcd))*100; //
30 disp(per," error in R is ,(%)=")
31 disp(pec," error in C is ,(%)=")
32 //answer is wrong in the textbook

```

Scilab code Exa 3.70 resistance

```

1 //Example 3.70: resistance
2 clc;
3 clear;

```

```

4 close;
5 w=5000; //rad/s
6 cab=0.2; //micro-F
7 zab=(-%i/(w*cab*10^-6)); //ohms
8 zbc=500; //ohm
9 l=0.1; //H
10 rcd=50; //ohm
11 zcd=rcd+%i*w*l; //ohm
12 cda=0.4; //micro-F
13 izda=-%i/(w*cda*10^-6); //
14 zda=(zab*zcd)/zbc; //
15 rs=real(zda); //ohms
16 disp(rs,"resistance is ,(ohm)=")

```

Scilab code Exa 3.71.a capacitance

```

1 //Example 3.71.a:resistance and capacitance
2 clc;
3 clear;
4 close;
5 c2=0.004; //micro-F
6 c3=0.001; //micro-F
7 r3=10; //killo ohms
8 r4=5; //killo ohms
9 f=1; //kHz
10 rx=(c3/c2)*r4; //killo ohms
11 cx=(r3/r4)*c2; //micro-F
12 disp(rx,"resistance is ,(k-ohm)=")
13 disp(cx,"capacitance is ,(micro-F)=")

```

Scilab code Exa 3.71.b capacitance

```

1 //Example 3.71.b:resistance and capacitance

```

```

2  clc;
3  clear;
4  close;
5  c1=10^-4; //micro-F
6  c2=0.004; //micro-F
7  c3=0.001; //micro-F
8  r3=10; //killo ohms
9  r4=5; //killo ohms
10 f=1; //kHz
11 rx=((c3+c1)/c2)*r4; // killo ohms
12 cx=(r3/r4)*c2; //micro-F
13 disp(rx,"resistance is ,(k-ohm)=")
14 disp(cx,"capacitance is ,(micro-F)=")

```

Scilab code Exa 3.72 inductance resistance and impedance

```

1  //Example 3.72:resistance and inductance
2  clc;
3  clear;
4  close;
5  r2=100; //ohm
6  r4=834; //ohm
7  c3=0.1; //micro-F
8  l1=r2*r4*c3*10^-3; //mH
9  c4=0.124; //micro-F
10 r1=(c3/c4)*r2; //
11 f=2; //kHz
12 z1=sqrt(r1^2+(2*%pi*f*10^3*l1*10^-3)^2); //
13 disp(l1,"inductance is ,(mH)=")
14 disp(r1,"resistance is ,(ohm)=")
15 disp(z1,"impedence is ,(ohm)=")

```

Scilab code Exa 3.73 value of M

```

1 //Example 3.73: inductance
2 clc;
3 clear;
4 close;
5 l1=4; //H
6 r1=1; //ohm
7 r2=1; //ohm
8 r3=2; //ohm
9 l4=2; //H
10 r4=2; //ohm
11 M=((r3*l1)-(r2*l4))/(r2+r3); //H
12 disp(M,"M is ,(H)=")

```

Scilab code Exa 3.74 resistance and inductance

```

1 //Example 3.74.a:resistance and inductance
2 clc;
3 clear;
4 close;
5 r2=500; //ohms
6 r3=300; //ohms
7 r4=500; //ohms
8 r=150; //ohms
9 c=2.5; //nano farads
10 rX=((r2*r3)/r4); //ohms
11 l=((c*10^-9*r3)/r4)*((r*(r2+r4))+(r2*r4)); //H
12 disp(rX,"resistance is ,(ohm)=")
13 disp(1*10^2,"inductance is ,(mH)=")

```

Scilab code Exa 3.75 current and iron loss

```

1 //Example 3.75:iron loss
2 clc;

```

```

3 clear;
4 close;
5 r2=18; //ohm
6 r4=550; //ohm
7 r3=1250; //ohm
8 r1=(r2*r4)/r3; //ohm
9 c3=0.5; //micro-F
10 l1=r2*r4*c3*10^-3; //mH
11 r4=550; //ohm
12 r31=1125; //ohm
13 r11=(r2*r4)/r31; //ohm
14 c31=3.85; //micro-F
15 l11=r2*r4*c31*10^-3; //mH
16 v=50; // volts
17 w=4000; //rad/s
18 i1=v/(sqrt((r1+r11)^2+(w^2*(l11*10^-3)^2))); //
19 t1=i1^2*r11; //W
20 c1=i1^2*r1; //W
21 il=t1-c1; //
22 disp(i1,"current is ,(A)=")
23 disp(il,"iron loss is ,(W)=")

```

Scilab code Exa 3.77 resistance and capacitance

```

1 //Example 3.77: parameters
2 clc;
3 clear;
4 close;
5 rab=1000; //ohm
6 f=1; //kHz
7 cab=0.5; //micro-F
8 zab=1/((1/rab)+(2*pi*f*10^3*cab*10^-6)); //
9 rbc=1000; //ohm
10 zbc=rbc-(2*pi*f*10^3*cab*10^-6); //
11 rcd=200; //ohm

```



```

12 lcd=30; //mH
13 zcd=rzd+(%i*2*%pi*f*10^3*lcd*10^-3); //
14 zda=(zab*zcd)/zbc; //ohm
15 R=real(zda); //
16 cda=1/(2*%pi*f*10^3*imag(zda)); //
17 disp(R,"resistance is ,(ohm)=")
18 disp(-cda*10^6,"capacitance is ,(micro-F)=")
19 x=sqrt(real(zda)^2+imag(zda)^2); //
20 rp=x; //ohms
21 cp=(((-imag(zda))/real(zda))*10^3)/(2*%pi*rp); //
22 disp(rp,"Rp is ,(ohm)=")
23 disp(cp,"Cp is ,(micro-F)=")
24 //Rp and Cp is calculated wrong in the textbook

```

Chapter 4

Potentiometer

Scilab code Exa 4.1 resistance

```
1 //Example 4.1: Unknown resistor
2 clc;
3 clear;
4 close;
5 //given data :
6 Vd=0.83942; // volt-drop in V
7 emf=23*10^-6; // in V
8 Vds=1.01575; // volt-drop in V
9 Rs=0.10014; // in ohm
10 Vdt=Vd-emf; // in V
11 I=Vds/Rs;
12 R=Vdt/I;
13 disp(R,"Unknown resistor ,R(ohm) = ")
```

Scilab code Exa 4.2 emf and percentage error

```
1 //Example 4.2: emf and % error
2 clc;
```

```

3 clear;
4 close;
5 //given data :
6 l=50; // in cm
7 l1=70; // in cm
8 l2=65; // in cm
9 l3=43.5; // in cm
10 I=0.45; // in A
11 V=1.0183; // in V
12 V1=1.35; // in V
13 R=2; // in ohm
14 Vp1=V/l; // in V/cm
15 emf=Vp1*l1;
16 disp(emf,"(a). emf of the cell ,(V) = ")
17 Vr=Vp1*l2;
18 P_error1=((V1-Vr)/Vr)*100;
19 disp(P_error1,"(b). % error (high) ,(%) = ")
20 Ir=(Vp1*l3)/R; // in A
21 P_error2=((I-Ir)/Ir)*100;
22 disp(P_error2,"(c). % error (high) ,(%) = ")

```

Scilab code Exa 4.3.a current and resistance

```

1 //Example 4.3.a: current and resistance
2 clc;
3 clear;
4 close;
5 e1=1.0191; //V
6 r1=100; //ohms
7 l=2; //m
8 I=1/r1; //A
9 e2=4; //V
10 rh=(e2/I)-r1; //
11 disp(I,"current is ,(A)=")
12 disp(rh,"resistance is ,(ohm)=")

```

Scilab code Exa 4.3.b current and resistance

```
1 //Example 4.3.B: current and resistance
2 clc;
3 clear;
4 close;
5 e1=4; //V
6 e2=1.0191; //V
7 R1=100; //OHM
8 R2=49.045; //OHMS
9 r3=R1-R2; //ohms
10 rg=50; //ohms
11 r4=200; //ohms
12 A=[r4 -r3;-r3 (r4+rg+r3)]; //
13 B=[e1;e2]; //
14 X=A\B; //
15 I2=X(2,1)*10^3; //
16 disp(I2,"current is ,(mA)=")
17 I1=((e1+(r3*10^-5))/r4); //mA
18 rp=((e2+(r3*I1)-(r4+rg+r3)*10^-5)/10^-5); //
19 disp(rp*10^-2,"resistance is ,(k-ohm)=")
20 //resistance is calculated wrong innthe textbook
```

Scilab code Exa 4.4 resistance

```
1 //Example 4.4: Resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 emf=1.01892; // in V
```

```

7 R=1; // in M-ohm
8 V=1.01874; // in V
9 Ic=V/R;
10 Vd=emf-V;
11 Ri=Vd/(Ic*10^-6);
12 disp(Ri,"internal resistance ,Ri(ohm) = ")

```

Scilab code Exa 4.5 resistance

```

1 //Example 4.5: Resistance
2 clc;
3 clear;
4 close;
5 //given data :
6 l=65; // in cm
7 V=0.1; // in V
8 V1=5.5; // in V
9 R=20; // in ohm
10 E=V*l;
11 I=V1/R;
12 Ri=(E-V1)/I;
13 disp(Ri,"Internal resistance ,Ri(ohm) = ")

```

Scilab code Exa 4.6 resistance

```

1 //Example 4.6: Resistance
2 clc;
3 clear;
4 close;
5 vr=5; //V
6 r=10; //k-ohm
7 x=vr*r*10^3; //
8 R=x; //

```

```
9 disp(R*10^-3,"resistance is ,(k-ohm)=")
```

Scilab code Exa 4.7 length of slide wire

```
1 //Example 4.7: Length
2 clc;
3 clear;
4 close;
5 //given data :
6 l=40; // in cm
7 r=0.5; // ion ohm
8 R=r*l/1; // in ohm
9 V=1.2; // in V
10 V1=6; // in V
11 I=V/R;
12 x=V1/(r*I);
13 disp(x,"The length of slide wire ,x(cm) = ")
```

Scilab code Exa 4.8 design

```
1 //Example 4.8: design
2 clc;
3 clear;
4 close;
5 vab=1; //V
6 vr=2-vab; //V
7 i=50; //mA
8 R=vr/(i*10^-3); //ohm
9 R1=(vr/10)/(i*10^-3); //ohm
10 n=10; //
11 tr1=n*R1; //ohm
12 r2=2*R1; //
13 l=100; //cm
```

```
14 x=R1/l; //
15 disp(R,"resistance R is ,(ohm)=")
16 disp(R1,"resistance R1 is ,(ohm)=")
17 disp(r2,"resistance R2 is ,(ohm)=")
18 disp(x,"resistance per cm of slide wire is ,(ohm/cm)
    =")
```

Scilab code Exa 4.9.a resistance

```
1 //Example 4.9.a:resistance
2 clc;
3 clear;
4 close;
5 st=15; //steps
6 r=5; //ohm
7 rsw=5.5; //ohm
8 tr=(st*r)+rsw; //ohm
9 vr=1.61; //V
10 i=vr/tr; //A
11 e2=1.61; //V
12 e1=2.40; //V
13 rh=(e1-e2)/i; //ohm
14 disp(rh,"resistance is ,(ohm)=")
```

Scilab code Exa 4.9.b resolution

```
1 //Example 4.9.b:resolution
2 clc;
3 clear;
4 close;
5 st=15; //steps
6 r=5; //ohm
7 rsw=5.5; //ohm
```

```

8 tr=(st*r)+rsw; //ohm
9 vr=1.61; //V
10 i=vr/tr; //A
11 e2=1.61; //V
12 e1=2.40; //V
13 rh=(e1-e2)/i; //ohm
14 trn=11; //turns
15 slwr=rsw/trn; //ohm
16 vd=slwr*i; //V
17 dv=100; //divisions
18 vedv=(1/dv)*vd; //
19 rs=vedv/5; //
20 disp(rs*10^6,"resolution of the instrument is ,(micro
    -V)=")

```

Scilab code Exa 4.9.c error

```

1 //Example 4.9.c:error
2 clc;
3 clear;
4 close;
5 st=15; //steps
6 r=5; //ohm
7 rsw=5.5; //ohm
8 tr=(st*r)+rsw; //ohm
9 vr=1.61; //V
10 i=vr/tr; //A
11 e2=1.61; //V
12 e1=2.40; //V
13 rh=(e1-e2)/i; //ohm
14 trn=11; //turns
15 slwr=rsw/trn; //ohm
16 vd=slwr*i; //V
17 dv=100; //divisions
18 vedv=(1/dv)*vd; //

```



```

19 rs=vedv/5; //
20 ig=0.05; //micro-A
21 vlt=1.1; //V
22 ir=50; //ohm
23 em=((ig*ir)); //
24 disp(em,"error is ,(micro-V)")

```

Scilab code Exa 4.10 power dissipated and mean stored energy

```

1 //Example 4.10:power dissipated
2 clc;
3 clear;
4 close;
5 r1=0.6-%i*0.24; //V
6 r2=0.6+%i*0.4; //V
7 r3=-0.1-%i*0.4; //V
8 f=50; //Hz
9 ir=1000; //ohm
10 i1=r1/ir; //A
11 pdr=(real(r1)*real(i1))+(imag(r1)*imag(i1)); //W
12 disp(pdr*10^3,"power dissipated in the resistor is ,(
    mW)=")
13 pdC=(real(r1)*real(i1))+(imag(r2)*imag(i1)); //W
14 disp(pdC*10^3,"power dissipated in the coil is ,(mW)=
    ")
15 pdc=(real(r3)*real(i1))-(imag(r2)*imag(i1)); //W
16 disp(pdc*10^3,"power dissipated in the capacitor is
    ,(mW)=")
17 imp=(r2/r1)*10^3; //ohm
18 rc=imag(imp); //ohm
19 indu=rc/(2*%pi*f); //H
20 ersl=(1/2)*(imag(i1)^2+real(i1)^2)*indu; //joules
21 disp(ersl*10^6,"energy stored in the coil is ,(micro-
    J)=")
22 admc=(r1*10^-3)/r3; //ohm^-1

```

```

23 C=imag(admc)/(2*pi*f); //
24 ersc=(1/2)*(imag(r3)^2+real(r3)^2)*C; //
25 disp(ersc*10^6,"energy stored in capacitor is ,(micro
    -J)=")

```

Scilab code Exa 4.11 measuring range resolution working current and setting

```

1 //Example 4.11:measuring range ,resolution ,working
    current ,setting of the rheostata
2 clc;
3 clear;
4 close;
5 sd=18; //steps
6 v1=0.1; //V
7 mr=(sd*v1)+v1; //V
8 disp(mr,"measuring range of the potentiometer is ,(V)
    =")
9 dv=100; //divisions
10 rs=(v1/dv)*(1/2); //mV
11 disp(rs*10^3,"resolution is ,(mV)=")
12 dr=10; //ohm
13 cdd=v1/dr; //A
14 disp(cdd*10^3,"current through the dial is ,(mA)=")
15 wbc=6; //V
16 rsv=wbc-mr; //V
17 sh=rsv/cdd; //ohm
18 disp(sh,"setting of the rheostat is ,(ohm)=")

```

Scilab code Exa 4.12 voltage and percentage error

```

1 //Example 4.12:voltage and percentage error
2 clc;

```

```

3 clear;
4 close;
5 st=15; //steps
6 r1=10; //ohm
7 v1=0.1; //V
8 r2=10; //ohm
9 r3=9.9; //ohm
10 v2=0.0185; //V
11 acr=(r1*r3)+((r2*v2)/v1); //ohm
12 v3=1.0185; //V
13 I=v3/acr; //
14 n=6; //
15 acr1=(n*r3)+(r2*0.0525)/v1; //ohm
16 tvr=I*acr1; //V
17 vg=0.6525; //
18 er=((tvr-vg)/tvr)*100; //
19 disp(tvr,"true value of drop across the resistance
      is ,(V)=")
20 disp(er,"percentage error is ,(%)=")

```

Scilab code Exa 4.13 resistanc and reactance

```

1 //Example 4.13:resistance and reactance
2 clc;
3 clear;
4 close;
5 r1=2; //ohm
6 r2=9; //
7 imp=r1+%i*r2; //ohm
8 mg=sqrt(r1^2+r2^2); //
9 th=atand(r2/r1); //
10 vm=85; //V
11 va=40; //degree
12 vm1=90; //V
13 va1=45; //degree

```

```

14 ccm=vm/mg; //A
15 cca=va-th; //degree
16 impm=vm1/ccm; //ohm
17 impa=va1-cca; //degree
18 reac=impm*sind(impa); //ohm
19 rc=sqrt(impm^2-reac^2); //ohm
20 f=50; //Hz
21 ind=reac/(2*%pi*f); //
22 disp(rc,"reactance is ,(ohm)=")
23 disp(fix(ind*10^3),"inductance of the coil is ,(mH)="
)

```

Scilab code Exa 4.14 limit of error and deflection

```

1 //Example 4.14: limit of error , deflection
2 clc;
3 clear;
4 close
5 x=17.5; //mm/micro-A
6 r1=850; //ohm
7 lr=r1*(1/x); //micro V
8 disp("limit of error in the reading is "+string(lr
) +" micro-V")
9 v1=2; //V
10 r2=80; //
11 i1=v1/r2; //A
12 v2=0.1; //V
13 r3=v2/i1; //ohm
14 v3=1.43; //V
15 r4=v3/i1; //ohm
16 l=50; //cm
17 l1=2; //mm
18 r5=((l1/10)/l)*r3; //ohm
19 fr=r4+r5; //ohm
20 fr1=22.784; //

```

```

21 R=(fr*fr1)/r2; //ohm
22 e=i1*fr; //V
23 ig=(e-v3)/(r1+R); //A
24 dg=ig*x*10^6; //mm
25 disp(dg," deflection of the galvanometer is ,(mm)=")

```

Scilab code Exa 4.15 current

```

1 //Example 4.15: Current
2 clc;
3 clear;
4 close;
5 //given data :
6 V1=4.2; // in V
7 V2=1.43; // in V
8 r1=21.0; // in ohm
9 r2=1; // in ohm
10 r3=15; // in ohm
11 I=V1/r1; // in A
12 R=V2/I; // in ohm
13 R1=R+r2;
14 R2=R-r2;
15 R3=round(R1*(r1-R1)/r1);
16 R4=R2*(r1-R2)/r1;
17 e1=R1*I;
18 e2=R2*I;
19 I1=(e1-V2)*10^3/(R3+r3);
20 I2=(V2-e2)*10^3/(R4+r3);
21 disp(I1," Current in one direction ,I1 (mA) = ")
22 disp(I2," Current in another direction ,I2 (mA) = ")

```

Chapter 5

Magnetic Measurement

Scilab code Exa 5.1 capacity of capacitor

```
1 //Example 5.1: Capacity of the capacitor
2 clc;
3 clear;
4 close;
5 //given data :
6 Ig=0.0001; // in A
7 T0=3; // in sec
8 theta0=200;
9 theta=45;
10 V=100; // in V
11 Q=(Ig*T0*theta0)/(theta*2*%pi);
12 C=(Q/V)*10^6;
13 disp(C,"Capacity of the capacitor ,C(micro-F) = ")
```

Scilab code Exa 5.2 coulomb sensitivity

```
1 //Example 5.2: Coulomb sensitivity
2 clc;
```

```

3 clear;
4 close;
5 //given data :
6 C=1.5*10^-6; // in F
7 V=15; // in V
8 d1=20; // in cm
9 Q=C*V;
10 Sb=(d1/Q)*10^-5;
11 disp(Sb,"Coulomb sensitivity ,Sb(mm/micro-C)")

```

Scilab code Exa 5.3.a logarithmic decrement

```

1 //Example 5.3.a: Logarithmic increment
2 clc;
3 clear;
4 close;
5 //given data :
6 theta1=12.5;
7 theta2=10;
8 lamda=log(theta1/theta2);
9 disp(lamda,"Logarithmic increment , = ")

```

Scilab code Exa 5.3.b frequency

```

1 //Example 5.3.b: frequency
2 clc;
3 clear;
4 close;
5 //given data :
6 theta1=12.5;
7 theta2=10;
8 lamda=log(theta1/theta2);
9 x=lamda^2; //

```

```

10 y=x/(%pi^2-x); //
11 y1=sqrt(y); //
12 f=0.125; //Hz
13 fo=f/(sqrt(1-y1^2)); //Hz
14 disp(fo,"undamped frequency is ,(Hz)=")

```

Scilab code Exa 5.4 flux density

```

1 //Example 5.3.b: Flux density
2 clc;
3 clear;
4 close;
5 //given data :
6 I1=5; // in A
7 I2=10; // in A
8 N1=100; // number of turns
9 N2=200; //number of turns
10 l=30*10^-2; // in m
11 R=200; // in ohm
12 theta1=45; // in degree
13 theta2=30; // in degree
14 As=0.3*10^-4; // in m^2
15 M=100*10^-3; // in H
16 k=(2*M*I1)/(R*theta1);
17 H=(N1*I2)/l;
18 fi=(R*k*theta2)/(2*N2);
19 B=fi/As;
20 mu=H/B;
21 disp(B,"Flux density ,B(Wb/m^2) = ")
22 disp(mu,"permeability ,mu(H/m) = ")
23 //flux density is calced wrong in the textbook

```

Scilab code Exa 5.5 flux density


```

1 //Example 5.5: Flux density and relative
  permeability
2 clc;
3 clear;
4 close;
5 //given data :
6 format('v',4)
7 A=5*10-4; // in m2
8 d=25*10-2; // in m
9 l=%pi*d;
10 N1=150; // turns
11 N2=300; // turns
12 k=2*10-6; // coulomb per division
13 R=2500; // in ohm
14 I=10; // in A
15 theta=75; // in division
16 mu_0=4*%pi*10-7;
17 B=(k*theta*R)/(2*N2*A);
18 disp(B,"Flux density ,B(Wb/m2) = ")
19 H=(N1*I)/l;
20 mu_r=(B/(mu_0*H));
21 disp(mu_r,"Relative permeability , = ")

```

Scilab code Exa 5.6 flux per pole and leakage coefficient

```

1 //Example 5.6 //flux per pole and leakage coefficient
2 clc;
3 clear;
4 close;
5 k=0.15; //micro-C
6 th=120; // divisions
7 th1=135; // divisions
8 r=4500; //ohm
9 n=3; //turns
10 ft=(k*10-6*th*r)/n; //Wb

```

```

11 n1=4; //
12 ft1=(k*10^-6*th1*r)/n1; //Wb
13 disp(ft,"In case of total flux is ,(Wb)=")
14 disp(ft1,"In case of useful flux is ,(Wb)=")
15 lk=ft/ft1; //
16 disp(lk,"leakage coefficient is ,=")

```

Scilab code Exa 5.7 relative permeability

```

1 //Example 5.7 //relative permeability
2 clc;
3 clear;
4 close;
5 n1=320; //turns
6 n2=250; //turns
7 i=10; //A
8 l=32; //cm
9 N=(n1*i)/(1*10^-2); //AT/m
10 f1=2.5*10^-4; //Wb
11 sd=100; //
12 k=(f1*i)/sd; //
13 sd1=270; ///
14 mo=4*%pi*10^-7; //
15 A=0.35; //cm^2
16 ur=((k*sd1)/(2*mo*N*A*10^-4*n2)); //
17 disp(ur,"relative permeability is ,=")

```

Scilab code Exa 5.8 resistance

```

1 //Example 5.7 // Shunt resistance
2 clc;
3 clear;
4 close;

```

```

5 //given data :
6 N=800;// turns
7 I=10;// in A
8 reluctance=150000;// in AT per Wb
9 fi=(N*I)/reluctance;
10 K=.15*10^-3;// in Wb turns/ division
11 rs=0.025;// in ohm
12 Ns=1;
13 theta=120;//divisions
14 S=(K*rs*theta)/((fi*Ns)-(K*theta));
15 disp(S,"The shunt resistance ,S(ohm) = ")

```

Scilab code Exa 5.9 magnetic potential difference

```

1 //Example 5.9 // Magnetic pole difference
2 clc;
3 clear;
4 close;
5 //given data :
6 format('v',4)
7 N=150;// turns
8 I=1.2;// in A
9 theta=300;// divisions
10 t=155;//change in mmf in division
11 mmf=N*I;
12 r=2*mmf;// du to reversal
13 K=360/t;
14 M=(K*theta);
15 disp(M,"The magnetic potential difference between
two points ,(AT) = ")

```

Scilab code Exa 5.10 relative permeability

```

1 //Example 5.10 //relative permeability
2 clc;
3 clear;
4 close;
5 n1=600; //turns
6 i=3; //A
7 d=30; //cm
8 H=(n1*i)/(%pi*d*10^-2); //
9 mo=4*%pi*10^-7; //
10 x=mo*H; //
11 as=6; //cm^2; //
12 y=as*10^-4*x; //
13 t1=500; //turns
14 z=t1*y; //
15 z1=2*z; //
16 r=250; //ohms
17 it=z1/r; //
18 k=3000; //micro-C
19 ur=(k*10^-6)/it; //
20 disp(round(ur), "relative permeability is,=")

```

Scilab code Exa 5.11 fluxmeter deflection

```

1 //Example 5.11 // Fluxmeter deflection
2 clc;
3 clear;
4 close;
5 //given data :
6 l=5*10^-2; // in m
7 N=40; // turns
8 B=5*10^-3; // in Wb/m^2
9 b=1.5*10^-2; // in m
10 cs=2*10^-4; // in m^2
11 B1=0.05; // in Wb/m^2
12 fi=B1*cs;

```

```

13 del_fi=2*fi;
14 theta=(del_fi*10)/(N*B*l*b);
15 disp((theta*(180/%pi)), "Fluxmeter deflection ,(degree
    ) = ")

```

Scilab code Exa 5.12 hysteresis and eddy current loss

```

1 //Example 5.12 //hysteresis and eddy current
  components
2 clc;
3 clear;
4 close
5 w1=132; //W
6 f1=20; //Hz
7 x=w1/f1; //
8 w2=425; //W
9 f2=50; //Hz
10 y=w2/f2; //
11 A=[1 f1;1 f2]; //
12 B=[x;y]; //
13 X=A\B; //
14 Wh=X(1,1)*f2; //W
15 We=X(2,1)*f2^2; //W
16 disp(Wh, "hysteresis current component of the loss is
    ,(W)=")
17 disp(We, "Eddy current component of the loss is ,(W)="
    )

```

Scilab code Exa 5.13 hysteresis loss

```

1 //Example 5.13 //hysteresis loss
2 clc;
3 clear;

```

```

4  close
5  Hx=125; //AT/m
6  ah=200; //cm^2
7  ba=0.15; //Wb/m^2
8  le=ah*Hx*ba; //J/m^3
9  lo=50; //loos
10 po=lo*le; //W/m^3
11 kg=8.5*10^3; //kg/m^3
12 lkg=po/kg; //watt
13 disp(lkg," hysteresis loss is ,(W)=")

```

Scilab code Exa 5.14 flux density

```

1  //Example 5.14 // flux density
2  clc;
3  clear;
4  close;
5  //given data :
6  R=200+50; // in ohm
7  k=100*10^-6; // in coulomb
8  theta=80; // divisions
9  A=55*10^-4; // in m^2
10 N=1500; // turns
11 B=(R*k*theta)/(2*A*N);
12 disp(B,"The flux density ,B(Wb/m^2) = ")

```

Scilab code Exa 5.15 loss

```

1  //Example 5.15 //loss
2  clc;
3  clear;
4  close
5  f=50; //Hz

```

```

6 k=2.3*10^-2; //
7 x=1.7; //
8 wi=0.6; //W
9 bm=0.5; //Wb/m^2
10 kd=((wi-(k*bm^x*f))/(bm^2*f^2)); //
11 f1=20; //Hz
12 bm1=1; //
13 wi1=((k*bm1^x*f1)+(kd*bm1^2*f1^2)); //
14 disp(wi1,"loss is ,(W)=")

```

Scilab code Exa 5.16 magnetic force flux density and relative permeability

```

1 //Example 5.16 //MAGNETIC FORCE ,FLUX DENSITY AND
  RELATIVE PERMEABILITY
2 clc;
3 clear;
4 close
5 k=1; //micro-C
6 th=100; //turns
7 r=5000; //ohm
8 n2=350; //turns
9 as=10; //cm^2
10 b=((k*th*r*10^-6)/(2*n2*as*10^-4)); //Wb/m^2
11 disp(b,"magnetic flux is ,(Wb/m^2)=")
12 n1=100; //turns
13 i=4; //A
14 l=100; //cm
15 H=(n1*i)/(l*10^-2); //AT/m^2
16 disp(H,"flux density is ,(AT/m^2)=")
17 mo=4*pi*10^-7; //
18 ur=b/(mo*H); //
19 disp(ur,"relative permeability is,=")

```

Scilab code Exa 5.17 constant

```
1 //Example 5.17 // fluxmeter
2 clc;
3 clear;
4 close;
5 //given data :
6 N1=800;// turns
7 I=5;// in A
8 l=1;// in m
9 A=5*10^-4;// in m^2
10 N=500;// turns
11 theta=25;// divisions
12 H=(N1*I)/l;
13 B=(4*pi*10^-7*H);
14 fi=B*A*10^8;
15 K=((2*N*fi*10^-8)/(theta));
16 disp(K*10^-3," Constant is ,(Wb-turn/scale-div)=")
```
