

Scilab Textbook Companion for  
Basic Electrical and Electronics Engineering  
by R. Muthusubramanian and S. Salivahanan<sup>1</sup>

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# Book Description

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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

## FUNDAMENTALS OF ELECTRICITY AND DC CIRCUITS

Scilab code Exa 1.1 RESISTANCE

```
1 //Chapter -1, Example 1.1, Page 18
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 // details for the first wire
7 l1=1; //length in m
8 R1=2; //resistance in ohms
9 x=R1; //say
10 d=1; //say
11 p=1; //say
12 d1=d; //say diameter in m
13 p1=p; //say specific resistance of wire
14 //details for the second wire
15 l2=3; //length in m
```

```

16 d=1; //say
17 p=1; //say
18 d2=2*d; //say diameter in m
19 p2=2*p; //say specific resistance of wire
20 //CALCULATIONS
21 R1=p1*l1/(%pi*d*d/4); //(R1=p1*l1/a1), where a1 is
    cross sectional area of first wire with diameter
    d as (%pi*d*d/4)-----equation 1
22 R2=p2*l2/(%pi*(4*d*d)/4); //(R2=p2*l2/a2), where a2
    is cross sectional area of second wire with
    diameter 2d as (%pi*((2*d)*(2*d))/4)-----
    equation 2
23 //dividing equation 1 by equation 2
24 z=R1/R2;
25 R2=x/z;
26 //OUTPUT
27 mprintf("Thus the resistance of second wire is %1.0 f
    ohm \n",R2);
28
29 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.2 RESISTANCE

```

1 //Chapter -1, Example 1.2, Page 18
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 l1=20; //length in cm for first case
7 l2=0.4; //length in cm for second case
8 w=0.1; //width in cm
9 t=0.4; //thickness in cm

```

```

10 p=1.7*10^-6//resistivity of copper in ohm cm
11 a1=0.1*0.4//area(w*t) in cm^2 for first case
12 a2=0.1*20//area(l*t) in cm^2 for second case
13 //CALCULATIONS
14 R1=p*l1/a1;//resistance in ohms for first case
15 R2=p*l2/a2;//resistance in ohms for second case
16 //OUTPUT
17 mprintf("Thus the resistance in first and second
           cases are %g ohms and %g ohms\n",R1,R2);
18
19 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.3 DIAMETER

```

1 //Chapter-1, Example 1.3, Page 19
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 la=1000;//length of aluminium wire in cm
7 da=0.2;//diameter in cm
8 pa=2.6*10^-6;//specific resistance of aluminium in
  ohm cm
9 pc=1.6*10^-6;//specific resistance of copper in ohm
  cm
10 lc=600;//length of copper wire in cm
11 i=2;//current in A passing through combination
12 ia=1.25;//current in A passing through aluminium
  wire
13 //CALCULATIONS
14 ic=i-ia;//current in A passing through copper wire
15 //resistance of aluminium wire in ohms

```

```

16 Ra=pa*la/(%pi*(da*da)/4);//(Ra=pa*la/a), where a is
    cross sectional area of aluminum wire with
    diameter da
17 Rc=ia/ic*Ra;//resistance of copper wire
18 dc=sqrt(4*pc*lc/Rc);//diameter of copper wire
19 //OUTPUT
20 mprintf("Thus the diameter of copper wire is %1.3f
    cm \n",dc);
21 //note:The answer given for diameter in text book is
    wrong.please check the calculations
22
23 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.4 RESISTANCE

```

1 //Chapter -1, Example 1.4, Page 20
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 l=10000;//length drawn from 10cc of copper in cm
7 p=1.7*10^-6;//Resistivity of copper in ohm cm
8 v=10;//volume of copper in cc
9 s1=10;//square sheet side in second case in cm
10 //CALCULATIONS
11 a=v/l;//area of cross-section in cm^2 in first case
12 R1=p*l/a;//resistance of wire in first case in ohm
13 a1=s1*s1;//area of cross-section in cm^2 in second
    case
14 l1=v/a1;//thickness in case 2 in cm
15 R2=p*l1/a1;//resistance of wire in second case in
    ohm

```

```

16 //OUTPUT
17 mprintf("Thus the resistance in first and second
    cases are %g ohms and %g ohms\n",R1,R2);
18
19 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.5 TEMPERATURE COEFFICIENT

```

1 //Chapter -1, Example 1.5, Page 21
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 t1=40;//temperature in degree centigrade
7 t2=100;//temperature in degree centigrade
8 R1=3.146;//resistance of platinum coli at t1
9 R2=3.767;//resistance of platinum coli at t2
10 //CALCULATIONS
11 x=R1/R2;
12 a0=((R1-R2)/(R2*t1-R1*t2));//temperature coefficient
    at 0 degree centigrade
13 R0=R1/(1+(a0*t1));//resistance at zero degree
    centigrade
14 a40=a0/(1+(a0*t1));//temperature coefficient at 40
    degree centigrade
15 //OUTPUT
16 mprintf("Thus the temperature coefficient at 0
    degree centigrade ,resistance at zero degree
    centigrade ,temperature coefficient at 40 degree
    centigrade are %f /degree centigrade ,%f ohms,%f
    /degree centigrade respectively \n",a0,R0,a40);
17

```

```
18
19 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 1.6 RESISTANCE

```
1 //Chapter -1, Example 1.6, Page 21
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 t1=12;//temperature in degree centigrade
7 t2=50;//temperature in degree centigrade
8 R1=0.4;//copper coil resistance in ohms
9 a0=0.004;//temperature coefficient of copper at zero
    degree centigrade
10 //CALCULATIONS
11 a12=1/((1/a0)+t1);//temperature coefficient at 12
    degree centigrade
12 R2=R1*[1+(a12*(t2-t1))];//resistance of copper wire
    in ohm at 52 degree centigrade
13 //OUTPUT
14 mprintf("Thus the resistance copper wire at 52
    degree centigrade is %1.2f ohm \n",R2);
15
16 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 1.7 TEMPERATURE

```
1 //Chapter -1, Example 1.7, Page 22
```



```

2 //
=====

3 clc;
4 clear;
5 //INPUT DATA
6 t1=20; //temperature in degree centigrade
7 R1=45; //shunt motor resistance at t1
8 R2=48.5; //new shunt resistance at t2
9 a0=0.004; //temperature coefficient of resistance at
    0 degree centigrade
10 //CALCULATIONS
11 x=R1/R2;
12 t2=((1+(a0*t1)-x)/(a0*x));
13 //OUTPUT
14 mprintf("Thus the temperature for new resistance is
    %d degree centigrade \n",t2);
15
16 //=====END OF PROGRAM
=====

```

### Scilab code Exa 1.8 TEMPERATURE RISE

```

1 //Chapter -1, Example 1.8, Page 22
2 //
=====

3 clc;
4 clear;
5 //INPUT DATA
6 V=180; //supply voltage in volts
7 I1=4; //initial current of coil in A
8 t1=20; //initial temperature
9 I2=3.4; //new decreased current of coil in A at
    temperature t2

```

```

10 a0=0.0043; //temperature coefficient in per degree
    centigrade
11 //CALCULATIONS
12 R1=V/I1; //initial resistance of coil in ohms
13 R2=V/I2; //resistance of coil after some time in ohms
14 x=R1/R2;
15 t2=(1+(a0*t1)-x)/(a0*x);
16 t=t2-t1; //temperature rise
17 //OUTPUT
18 mprintf("Thus the temperature rise is %2.2f degree
    centigrade \n",t);
19
20 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.9 CURRENT

```

1 //Chapter -1, Example 1.9, Page 23
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 t2=2750; //temperature in degree centigrade for
    tungsten lamp
7 P=150; //power in watts
8 V=230; //voltage in volts
9 t1=16; //temperature in degree centigrade
10 a0=0.0047; //temperature coefficient of tungsten in
    per degree centigrade
11 //CALCULATIONS
12 R2=(V*V)/P;
13 a1=1/((1/a0)+t1); //temperature coefficient of
    resistant at 16 degree centigrade

```

```

14 R2=(V*V)/P; //Resistance of the filament of the lamp
    under normal working condition
15 R1=R2/[1+(a1*(t2-t1))]; //resistance of copper wire
    in ohm at 52 degree centigrade
16 I2=V/R2; //normal current taken by lamp
17 I1=V/R1; //current taken at the moment of switching
    on
18 //OUTPUT
19 mprintf("Thus the normal current taken by lamp and
    current taken at the moment of switching on are
    %1.4f A and %1.4f A respectively ",I2,I1);
20
21 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.10 EFFICIENCY

```

1 //Chapter -1, Example 1.10, Page 23
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 m1=2; //mass of water in kg
7 theta1=20; //temperature 20 degree centigrade
8 theta2=100; //temperature 100 degree centigrade(
    boiling point of water)
9 t=1/10; //time taken to boil water in hr
10 x=40; //cost of energy of 1kwh in paise for one unit
11 y=12; //cost of energy consumed
12 S=1; //specific heat of water
13 //CALCULATIONS
14 H=m1*S*(theta2-theta1); //heat energy required to
    raise temperature from theta1 to theta2 in kcals

```

```

15 H=H/860;//heat energy in Kwh
16 E=(12/40);//electrical energy or input energy to
    kettle in Kwh
17 n=H/E*100;//efficiency of kettle in percentage;
18 P=E/t;//power rating of kettle
19 //OUTPUT
20 mprintf("Thus the efficiency of kettle in percentage
    and power rating of kettle is %d and %1.0f Kw",
    n,P);
21
22
23 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.11 RESISTANCE

```

1 //Chapter –1, Example 1.11, Page 24
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 m=2;//mass of water in kg
7 theta1=20;//temperature 20 degree centigrade
8 theta2=100;//temperature 100 degree centigrade(
    boiling point of water)
9 t=0.25;//time taken to boil water in hr
10 V=240;//power supply in volts
11 n=80;//efficiency of kettle in percentage
12 S=1;//specific heat of water
13 //CALCULATIONS
14 H=m*S*(theta2-theta1);//output energy from the
    kettle in kcal
15 H=H/860;//output energy from the kettle in kwh

```

```

16 n=n/100;
17 E=H/n;//electrical energy or input energy to kettle
    in Kwh
18 P=E/t;//power rating of kettle in Kw
19 P=P*1000;//power rating of kettle in w
20 R=(V*V)/P;//resistance of heating element in ohms
21 //OUTPUT
22 mprintf("Thus the resistance of heating element is
    %2.2f ohms",R);
23
24
25 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.12 TIME

```

1 //Chapter –1, Example 1.12, Page 24
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 m=20;//mass of aluminium in kg
7 S=0.896;//specific heat of aluminium in KJ/Kg degree
    centigrade
8 L=402;//latent heat of fusion of aluminium in KJ/Kg
9 theta2=657;//final temperature
10 theta1=20;//initial temperature(assumed)
11 P=25;//power of furnace in Kw
12 n=80;//efficiency of kettle in percentage
13 //CALCULATIONS
14 H=m*S*(theta2-theta1)+(m*L);//heat energy required
    to melt aluminium or energy output from the
    furnace in Kj

```

```

15 H=H/4.186; //heat energy required to melt aluminium
    or energy output from the furnace in Kcal
16 H=H/860; //heat energy required to melt aluminium or
    energy output from the furnace in KWh
17 n=n/100;
18 E=H/n; //electrical energy or input energy to kettle
    in Kwh
19 t=E/P; //time taken to melt the aluminium in hr
20 t=t*60; // time taken to melt the aluminium in min
21 //OUTPUT
22 printf("Thus the time taken to melt the aluminium
    is %2.2 f min",t);
23
24
25 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.13 ENERGY

```

1 //Chapter -1, Example 1.13, Page 25
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 m=80000; //mass of water lifted by pump in Kg/min
7 g=9.81; //gravity constant in m/sec^2
8 h=2; //pump is in operation for two hours a day
9 d=30; //pump is in operation for 30 days
10 T=h*d; //total time for which pump is in operation in
    hrs
11 n=70; //efficeincy in percentage
12 h=12; //the height in m to which pump lifts water
13 C=50; //cost of energy in paise/Kwh

```

```

14 //CALCULATIONS
15 P=m*g*h;//potential energy possessed by water per
    minute or workdone by motor pump/minute measured
    in joules
16 P=P/60;//potential energy possessed by water per
    minute or workdone by motor pump/minute measured
    in joules/sec or watts.
17 O=P/1000;//output power of motor in Kw
18 n=n/100;
19 E=O/n;//input power of motor in Kw
20 Et=E*T;//total energy supplied or energy consumption
    in Kwh
21 C=C/100;//cost of energy in Rs/Kwh
22 Ct=C*Et;//Total cost of energy
23 //OUTPUT
24 printf("Thus the total cost of energy is Rs %4.0f"
    ,Ct);
25
26
27 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.14 VOLUME

```

1 //Chapter –1, Example 1.14, Page 26
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 P=100;//power of power station in MW
7 g=9.81;//gravity constant in m/sec^2
8 h=200;//effective head of power station in m
9 n=80;//efficiency of station in percentage

```

```

10 t=10; //operation time of power station
11 //CALCULATIONS
12 E1=P*t; // energy output from the station in 10 hours
    measured in MWh
13 n=n/100;
14 E2=P*t/n; //energy input to the station in 10 hours
    measured in MWh
15 E2=E2*10^6*60*60; //energy input to the station in 10
    hours measured in Wsec or joules
16 //energy input to the station is equal to potential
    energy supplied by water to station
17 m=E2/(g*h); //mass in kg of water used
18 d=1000; //density of water in kg/m^3
19 V=m/d; //volume of water used in 10 hours
20 //OUTPUT
21 printf("Thus the volume of water used in 10 hours
    is %e cubic metre",V);
22
23
24 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.15 VELOCITY

```

1 //Chapter -1, Example 1.15, Page 26
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 I=20; //current in A
7 V=8; //supply voltage in V
8 t=3600; //1hr=3600sec
9 m=1000; //mass in kg(1 tonne= 1000 kg)

```



```

10 //kinetic energy = energy dissipated in the
    resistance ——eqn(1)
11 //CALCULATIONS
12 E=V*I*t; // energy dissipated in resistance in joules
13 v=sqrt(E/(0.5*m)); //kinetic energy possessed by body(
    K=0.5*m*v*v) and using eqn(1),we found out
    velocity in m/sec
14 //OUTPUT
15 mprintf("Thus the velocity is %2.2f m/sec",v);
16
17
18 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.16 RESISTIVITY

```

1 //Chapter –1, Example 1.16, Page 27
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 I=7.9; //current in A
7 V=240; //supply voltage in V
8 t=55; //temperature in degree centigrade
9 a0=0.00029; //temperature coefficient in ohm/ohm/
    degree centigrade
10 l=15.6; //length of wire in m
11 a=12; //cross-sectional area in mm^2
12 //CALCULATIONS
13 R=V/I; //resistance of wire in ohm
14 p=R*a/l; //resistivity of wire in ohm metre
15 Rt=R*(1+(a0*t)); //resistance at 55 degree centigrade
    in ohm

```

```

16 I1=V/Rt;//current through wire at temperature 55
    degree centigrade in A
17 //OUTPUT
18 mprintf("Thus the resistivity and current through
    wire at temperature 55 degree centigrade are %2.2
    f micro ohm meter and %2.2f A respectively",p,I1)
    ;
19
20
21 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.17 RESISTANCE

```

1 //Chapter –1, Example 1.17, Page 27
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R1=0.031;//resistance of wire in ohm
7 d1=11.7;//diameter of wire in mm in case 1
8 r1=d1/2;//radius of wire in mm in case 1
9 d2=5;//diameter of wire in mm in case 2
10 r2=d2/2;//radius of wire in mm in case 2
11 // we know that resistance is inversely proportional
    to square of area of cross–section
12 //CALCULATIONS
13 R2=R1*(((%pi*r1*r1)/(%pi*r2*r2)))^2;//resistance of
    wire in case 2
14 //OUTPUT
15 mprintf("Thus the new resistance of wire is %1.4f
    ohms",R2);
16

```

```
17
18 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 1.18 RESISTANCE

```
1 //Chapter –1, Example 1.18, Page 27
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 p20=1.724*10-8; //specific resistance of copper in
    ohm m
7 a=0.0043; //temperature coefficient of copper at 0
    degree centigrade measured in per degree
    centigrade
8 r1=8; //inner radius of copper circular ring in cm
9 r2=6; //axial thickness in cm
10 r3=4; //radial thickness in cm
11 a1=r2*r3*10-4; //area of cross-section of ring in m
    ^2
12 r2=r2*2;
13 l=%pi*((r1+r2)/2)/100; //length of semicircular ring
    between faces in m
14 t1=20; //temperature 20 degree centigrade
15 t2=50; //temperature 50 degree centigrade
16 //CALCULATIONS
17 R20=p20*(l/a1); //resistance of ring at 20 degree
    centigrade in ohm
18 R50=R20*[(1+(a*t2))/(1+(a*t1))]; //resistance of ring
    at 50 degree centigrade in ohm
19 //OUTPUT
20 printf("Thus the resistance of wire at 50 degree
```

```

    centigrade is %g ohms",R50);
21
22
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.19 RESISTIVITY

```

1 //Chapter-1, Example 1.19, Page 28
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 l1=0.5;//length of copper rod in m
7 a=0.00426;//temperature coefficient of copper
    measured in per degree centigrade
8 R1=4.25*10^-4;//resistance of wire at 15 degree
    centigrade in ohm
9 d1=5*10^-3;//diameter of copper rod in m in case 1
10 r1=0.5*d1;//radius of copper rod in m in case 1
11 a1=%pi*((r1)^2);//area of cross-section in m^2 in
    case 1
12 t1=15;//temperature in degree centigrade
13 t2=50;//temperature in degree centigrade
14 //CALCULATIONS
15 p=R1*a1/l1;//resistivity in ohm-m
16 d2=1*10^-3;//diameter of copper rod in m in case 2
17 r2=d2/2;//radius of copper rod in m in case 2
18 a2=%pi*(r2)^2;//area of cross-section in m^2 in case
    2
19 R15=(a1/a2)^2*R1;//resistance at 15 degree
    centigrade
20 R50=R15*((1+(a*t2))/(1+(a*t1)));

```

```

21 //OUTPUT
22 mprintf("Thus the resistance of wire at 50 degree
    centigrade is %1.4f ohm",R50);
23
24
25 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.20 DIAMETER

```

1 //Chapter –1, Example 1.20, Page 28
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 l1=7.5;//length of aluminium wire in m
7 d1=1*10^-3;//diameter of aluminium wire in m
8 r1=0.5*d1;//radius of aluminium wire in m
9 a1=%pi*((r1)^2);//area of cross-section in m^2 for
    aluminium wire
10 p1=0.028;//resistivity of aluminium in micro ohm-m
11 l2=6;//length of copper wire in m
12 p2=0.017;//resistivity of copper in micro ohm-m
13 I=5;//current through parallel combination in A
14 I1=3;//current through aluminium wire in A
15 I2=I-I1;//current through copper wire in A
16 //CALCULATIONS
17 R1=p1*l1/a1;//resistance of aluminium wire in ohm
18 V1=I1*R1;//voltage drop across the end of Al wire in
    V
19 //since the wires are connected in parallel ,so V1=V2
20 a2=I2*p2*l2/V1;//area of cross-section in m^2 for
    copper wire

```

```

21 d2=sqrt(4*a2/%pi); //diameter of copper wire in m
22 //OUTPUT
23 mprintf("Thus the diameter of copper wire is %g m",
    d2);
24
25 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.22 TEMPERATURE RISE

```

1 //Chapter -1, Example 1.22, Page 29
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R20=100; //resistance of coil at 20 degree centigrade
    in ohms
7 R45=110; //resistance of coil at 45 degree centigrade
    in ohms
8 Rt=124; //resistance of coil at t degree centigrade
    in ohms
9 t1=20; //temperature in degree centigrade
10 t2=15; //temperature in degree centigrade
11 a=R45/R20;
12 //CALCULATIONS
13 a0=(a-1)/(45-(20*a)); //temperature coefficient of
    coil at 0 degree centigrade
14 x=(Rt/R20);
15 t=(x)*(1+(a0*t1));
16 t=t-1;
17 t=(t)*(1/a0); //temperature of coil when Rt=124
    ohms measured in degree centigrade
18 deltat=t-t2; //mean temperature rise

```

```

19 //OUTPUT
20 mprintf("Thus the mean temperature rise is %2.0f
    degree centigrade",deltat);
21
22
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.23 TEMPERATURE RISE

```

1 //Chapter –1, Example 1.23, Page 30
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R20=18;//resistance of coil at 20 degree centigrade
    in ohms
7 R50=20;//resistance of coil at 50 degree centigrade
    in ohms
8 Rt=21;//resistance of coil at t degree centigrade in
    ohms
9 t1=20;//temperature in degree centigrade
10 t2=50;//temperature in degree centigrade
11 t3=15;//temperature in degree centigrade
12 a=R50/R20;
13 //CALCULATIONS
14 a0=(a-1)/(50-(20*a));//temperature coefficient of
    coil at 0 degree centigrade
15 x=(Rt/R50);
16 t=(x)*(1+(a0*t2));
17 t=t-1;
18 t=(t)*(1/a0);////temperature of coil when Rt=21 ohms
    measured in degree centigrade

```

```

19 deltat=t-t3;//mean temperature rise
20 //OUTPUT
21 mprintf("Thus the mean temperature rise is %2.0f
    degree centigrade",deltat);
22
23
24 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.24 CURRENT

```

1 //Chapter -1, Example 1.24, Page 40
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R1=4;//resistance in ohms
7 R2=6;////resistance in ohms
8 I=30;//current through parallel combination in A
9 //CALCULATIONS
10 I1=I*(R2/(R1+R2));//current through resistor1 in A
11 I2=I-I1;//current through resistor2 in A
12 //OUTPUT
13 mprintf("Thus the current through resistor1 and
    resistor2 are %d A and %d A respectively",I1,I2)
    ;
14 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.25 POWER



```

1 //Chapter -1, Example 1.25, Page 41
2 //

```

---

```

3 clc;
4 clear;
5 //INPUT DATA
6 R1=2;//resistance1 in ohms
7 R2=3;//resistance2 in ohms
8 R3=4;//resistance3 in ohms
9 R4=5;//resistance4 in ohms
10 P=100;//total power absorbed in watts
11 //CALCULATIONS
12 RT=((R2*R3*R4)+(R1*R3*R4)+(R1*R2*R4)+(R1*R2*R3))/(R1
    *R2*R3*R4);
13 RT=1/RT;//equivalent resistance of parallel
    combination of R1,R2,R3,R4 Resistors
14 V=sqrt(P*RT);//voltage in volts that has to be
    applied to absorb 100w of power
15 //OUTPUT
16 mprintf("Thus the voltage in volts that has to be
    applied to absorb 100w of power is %1.3f V ",V);
17 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.26 RESISTANCE

```

1 //Chapter -1, Example 1.26, Page 41
2 //

```

---

```

3 clc;
4 clear;
5 //INPUT DATA
6 V=230;//supply voltage in volts

```

```

7 I1=12;//initial current in A
8 I2=16;//final current in A
9 //CALCULATIONS
10 I=I2-I1;//current through the resistance placed in
    parallel in A
11 R=V/I;//resistance in ohms by ohm's law
12 //OUTPUT
13 mprintf("Thus the resistance placed in parallel is
    %2.1f ohm ",R);
14 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.27 CURRENT

```

1 //Chapter -1, Example 1.27, Page 41
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 I=12.1;//current in A entering the parallel
    combination of resistors
7 I1=7.2;//current in A in resistor 1
8 R1=50;//resistance1 in ohm
9 R2=100;//resistance2 in ohm
10 //CALCULATIONS
11 V=I1*R1;//supply voltage in volts by ohms law(V=I*R)
12 I2=V/R2;//current through R2 in A by ohms law
13 I3=I-I1-I2;//current through resistance3 R3 in A by
    ohms law
14 R3=V/I3;//resistance in ohm
15 //OUTPUT
16 mprintf("Thus the value of third resistance placed
    is %3.2f ohm ",R3);

```

```
17 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 1.28 RESISTANCE

```
1 //Chapter -1, Example 1.28, Page 42
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R1=3.6;//resistance in ohm
7 R2=4.56;//resistance in ohm
8 RT=6;//resistance in ohm
9 //CALCULATIONS
10 X=RT-(R2);
11 R3=(X*R1)/(R1-X);
12 //OUTPUT
13 mprintf("Thus the value of third resistance placed
    is %1.1f ohm ",R3);
14 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 1.29 RESISTANCE

```
1 //Chapter -1, Example 1.29, Page 42
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
```

```

6 P=70; //total power dissipated in circuit in watts
7 V=22; //applied voltage in volts
8 I=P/V; //total current through the circuit in Amps
9 R1=12; //resistance 1 of parallel combination in ohms
10 R2=8; //resistance 2 of parallel combination in ohms
11 //CALCULATIONS
12 RP=(R1*R2)/(R1+R2); //equivalent resistance of
    parallel combination in ohms
13 VP=I*RP; //voltage across parallel combination in
    volts
14 VR=V-VP; //voltage across the resistance R# in volts
15 R3=VR/I; //by ohm's law
16 //OUTPUT
17 mprintf("Thus the value of third resistance placed
    is %1.2f ohms ",R3);
18 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.30 EMF

```

1 //Chapter-1, Example 1.30, Page 43
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 P=70; //total power dissipated in circuit in watts
7 V1=6; //since applied voltage E is 6V, as per the
    characteristics of parallel circuit P.D across R1
    is
8 V2=6; //V1=V2, in volts
9 R1=12; //resistance1 in parallel combination in ohms
10 R2=6; //resistance2 in parallel combination in ohms
11 R3=6.25 //resistance3 in series with parallel

```

```

        combination in ohms
12 I1=V1/R1; // current through the resistance R1 in
    Amps
13 I2=V2/R2; //current through the resistance R2 in Amps
14 r=0.25; //internal resistance in ohm
15 //CALCULATIONS
16 I=I1+I2; //total current through parallel combination
17 E=(I*r)+(I*R3)+V2; //emf of battery in Volts
18 //OUTPUT
19 mprintf("Thus the value of emf of battery in Volts
    is %2.2f volts ",E);
20 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.31 CURRENT

```

1 //Chapter –1, Example 1.31, Page 44
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 E=12; //emf of battery in volts
7 R1=3; //resistance1 in parallel combination in ohms
8 R2=4; //resistance2 in parallel combination in ohms
9 R3=6; //resistance3 in parallel combination in ohms
10 R4=4; //resistance4 in series with parallel
    combination in ohms
11 r=6; //internal resistance in ohm
12 //CALCULATIONS
13 RP=((R2*R3)+(R3*R1)+(R1*R2))/(R1*R2*R3);
14 RP=1/RP; //equivalent resistance of parallel
    combination in ohms
15 RT=RP+R4+r; //total circuit resistance in ohms

```

```

16 I=E/RT;//total circuit current in A
17 V=E-(I*r);//terminal voltage of battery in volts
18 //OUTPUT
19 mprintf("Thus the terminal voltage of battery is %1
    .3f volts ",V);
20 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.32 CURRENT

```

1 //Chapter –1, Example 1.32, Page 45
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 V=24;//supply voltage of battery in volts
7 Rab=13;//resistance between A and B points in ohms
8 Rbc=11;//resistance between B and C points in ohms
9 Rbe=18;//resistance between B and E points in ohms
10 Rce=14;//resistance between C and E points in ohms
11 Red=9;//resistance between E and D points in ohms
12 Rcd=5;//resistance between C and D points in ohms
13 Rae=22;//resistance between A and E points in ohm
14 Rx=Rae;
15 Ry=Rbe;
16 Raf=1;//resistance between A and F points in ohms
17 //CALCULATIONS
18 Rce=((Rcd+Red)*(Rce))/(Rcd+Red+Rce);//equivalent
    resistance of Rce in ohms
19 Rbe=((Rbc+Rce)*(Rbe))/(Rbc+Rce+Rbe);//equivalent
    resistance of Rbe in ohms
20 Rae=((Rab+Rbe)*(Rae))/(Rab+Rbe+Rae);//equivalent
    resistance of Rae in ohms

```

```

21 RT=Rae+Raf; //total equivalent circuit resistance in
    ohms
22 Iaf=V/RT; //current through resistance Raf in A
23 Vae=V-(Iaf*Raf); //P.D across AE in volts
24 Iae=Vae/Rx; //current in AE in A
25 Iab=Iaf-Iae; //current in AB in A
26 Vab=Rab*Iab; //P.D across AB in volts
27 Vbe=Vae-Vab; //Voltage across branch BE in volts
28 Pbe=((Vbe)^2)/(Ry); //power absorbed in branch Be in
    watts
29 Ibe=Vbe/Ry; //current in BE in A
30 Ibc=Iab-Ibe; //current in BC in A
31 Icd=(Ibc)/(2); //current in CDE in A
32 Vcd=Icd*(Rcd); //P.D across CD
33 //OUTPUT
34 printf("Current in branch AF is %d A \n Power
    absorbed in BE is %1.1f watts \n P.D across CD is
    %1.2f volts ",Iaf,Pbe,Vcd);
35 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.33 CURRENT

```

1 //Chapter-1, Example 1.33, Page 46
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 V1=25; //supply voltage1 of battery in volts
7 V2=45; //supply voltage2 of battery in volts
8 R1=6; //resistance1 in ohms
9 R3=4; //resistance2 in ohms
10 R2=3; //resistance3 in ohms

```

```

11 //let I1 be the current in loop1 and I2 current be
    in loop2
12 //CALCULATIONS
13 //V1=((R1+R3)*(I1)-(R3*I2));//applying KVL in loop1
    -----eqn(1)
14 //V2=((R3)*(I1)-(R2+R3)*(I2));//applying KVL in
    loop2 -----eqn(2)
15 //solving both eqn(1) and eqn(2)
16 [a]=[(R1+R3),-R3;(R3),-(R2+R3)]
17 [b]=[V1;-V2]
18 [c]=inv(a)*(b)//ax=b
19 c1=c(1);//c1 is current in branch FABC measured in A
20 c2=c(2);//c2 is current in branch CDEF measured in A
21 c3=c1-c2;//current in branch CF in A
22 //OUTPUT
23 printf("Current in R1 is %1.4f A \n current in R2
    is %2.3f A \n current in R3 is %1.3f A\n ",c1,c2
    ,c3);
24 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.34 CURRENT

```

1 //Chapter -1, Example 1.34, Page 46
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 V=4.5;//supply voltage of battery in volts
7 RAB=1000;//resistance between A and B points in ohms
8 RBC=100;//resistance between B and C points in ohms
9 RAD=5000;//resistance between A and D points in ohms
10 RCD=450;//resistance between C and D points in ohms

```



```

11 Rg=500; //resistance of galvanometer in ohms
12 //let I1 be the current across RAB and I1-Ig across
    RBC and I2 across RAD and I2+Ig across RCD and I
    be the total current
13 //where I=I1+I2
14 //CALCULATIONS
15 //((-RAB*I1)-(Rg*Ig)+(RAD*I2))=0;//applying KVL to
    loop ABDA -----eqn(1)
16 //((-RBC*I1)+((Rg+RCD+RBC)*(Ig))+(RCD*I2))=0;//
    applying KVL to loop BCDB -----eqn(2)
17 //((RAD+RCD)*I2)+(RCD*Ig)=V;//applying KVL to loop
    EADCFE-----eqn(3)
18 //solving eqn(1),eqn(2) and eqn(3)
19 [a]=[-RAB,-Rg,RAD;-RBC,(Rg+RCD+RBC),RCD;0,RCD,(RAD+
    RCD)];
20 [b]=[0;0;V];
21 [c]=inv(a)*(b) //ax=b
22 I1=c(1); //c1 is current in branch FABC measured in A
23 Ig=c(2); //c2 is current in branch CDEF measured in A
24 I2=c(3); //current in branch CF in A
25 //OUTPUT
26 mprintf("Current through galvanometer is %g A \n
    since the answer is positive our assumed
    direction is correct ",Ig);
27 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.35 CURRENT

```

1 //Chapter -1, Example 1.35, Page 47
2 //
    =====
3 clc;
4 clear;

```

```

5 //INPUT DATA
6 V1=8; //supply voltage of battery in loop1 in volts
7 V2=4; //supply voltage of battery in loop2 in volts
8 RED=200; //resistance between E and D points in ohms
9 RAD=20; //resistance between A and D points in ohms
10 RCD=50; //resistance between C and D points in ohms
11 //let I1 be the current across path AFED and I2
    across AD and I1-I2 across path DCBA
12 //CALCULATIONS
13 //((RCD*I1)-(RAD+RCD)*I2)=4; //applying KVL to loop
    ADCBA -----eqn(1)
14 //((RED*I1)+(RAD*I2))=8; //applying KVL to loop AFEDA
    -----eqn(2)
15 //solving eqn(1) and eqn(2)
16 [a]=[RCD,-(RAD+RCD);RED,RAD];
17 [b]=[4;8];
18 [c]=inv(a)*(b) //ax=b
19 I1=c(1); //c1 is current across path AFED in A
20 I2=c(2); //c2 is current across AD in A
21 //OUTPUT
22 mprintf("Current in 20 ohm resistor is %f A \n
    since the answer is negative, the current actually
    flows from A to D ",I2);
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.36 RESISTANCE

```

1 //Chapter -1, Example 1.36, Page 48
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA

```

```

6 Rs=25; //total resistance when two resistances are
   connected in series in ohms
7 Rp=6; //total resistance when two resistances are
   connected in parallel in ohms
8 //let individual resistances be R1 and R2 ohms
9 //CALCULATIONS
10 //Rs=(R1+R2)---eqn(1)
11 //Rp=((R1*R2)/(R1+R2))---eqn(2)
12 //let (R1*R2)=x
13 //let (R1-R2)=y
14 //solving eqn(1) and eqn(2)
15 x=Rs*Rp; //in ohms
16 y=sqrt((Rs)^2-(4*x)); //eqn---(3)
17 //solving eqn(1) and eqn(3)
18 z=Rs+y;
19 R1=z/2; //resistance1 in ohms
20 R2=Rs-R1; //resistance2 in ohms
21 //OUTPUT
22 mprintf("Thus the individual resistances are R1=%d
   ohms and R2=%d ohms ",R1,R2);
23 //=====END OF PROGRAM
   =====

```

---

### Scilab code Exa 1.37 CURRENT

```

1 //Chapter-1, Example 1.37, Page 48
2 //
   =====
3 clc;
4 clear;
5 //INPUT DATA
6 P=16; //total power dissipated in circuit in Watts
7 R1=4; //resistance R1 in Ohms
8 R2=2; //resistance R2 in Ohms

```

```

 9 R3=8; //resistance R3 in Ohms
10 V=8; //supply voltage in volts
11 //let resistance parallel to R1 is R ohms
12 //CALCULATIONS
13 Reff=((V^2)/P); //total effective resistance of
    circuit in ohms
14 x=((R2*R3)/(R2+R3)); //effective resistance of 2nd
    parallel circuit in ohms
15 z=(Reff-x); //effective resistance of 1st parallel
    circuit where  $z=((R1*R)/(R1+R))$  in ohms———eqn
    (1)
16 //solving for R in eqn(1)
17 R=(R1*z)/(R1-z);
18 Reff=((R1*R)/(R1+R))+x; //in ohms
19 I=V/Reff; //total current in A
20 mprintf("Thus the total current is I=%d A ",I);
21 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.38 CURRENT

```

1 //Chapter –1, Example 1.38, Page 49
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R1=2; //resistance R1 in Ohms
7 R2=12; //resistance R2 in parallel circuit measured
    in ohms
8 R3=20; //resistance R3 in parallel circuit measured
    in ohms
9 R4=30; //resistance R4 in parallel circuit measured
    in ohms

```

```

10 R5=2; //resistance R5 in ohms
11 V=100; //supply voltage in volts
12 //CALCULATIONS
13 Reff=(R1)+((1)/((1/R2)+(1/R3)+(1/R4)))+(R5); //total
    effective resistance of circuit in ohms
14 I=V/Reff; //total current in A
15 // let individual currents in 3 parallel resistance
    network be I1,I2,I3 respectively
16 //Then I1+I2+I3=I——eqn(1)
17 //where I2=(I1*R1/R2) and I3=(I1*R1/R3)
18 //solving for I1 in eqn(1)
19 I1=I/2; //in A
20 I2=(I1*R2/R3); //in A
21 I3=(I1*R2/R4); //in A
22 mprintf(" I1=%d A \n I2=%1.0 f A \n I3=%1.0 f A",I1,I2,
    I3);
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.39 RESISTANCE

```

1 //Chapter –1, Example 1.39, Page 49
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 V=100; //supply voltage in volts
7 I=10; //total current in A
8 P1=600; //power dissipated in coil in Watts
9 //CALCULATIONS
10 //Reff=((R1*R2)/(R1+R2)) is total effective
    resistance of circuit in ohms——eqn(1)
11 Reff=V/I; //total effective resistance of circuit in

```

```

        ohms
12 R1=((V)^2)/(P1); //in ohms——eqn(2)
13 //solving for R2 in eqn(1)
14 R2=((Reff*R1)/(R1-Reff)); //in ohms
15 mprintf("R1=%2.2 f Ohms \n R2=%1.0 f Ohms ",R1 ,R2);
16 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 1.40 CURRENT

```

1 //Chapter –1, Example 1.40, Page 50
2 //
=====
3 clc;
4 clear;
5 //INPUT DATA
6 R1=5; //resistance in ohms
7 P=20; //power dissipated in R1 in Watts
8 R2=10; //Resistance parallel to R1
9 //CALCULATIONS
10 I1=sqrt(P/R1); //current through R1 in A
11 I=((R1+R2)/(R2))*(I1); //total supply current in A
12 mprintf(" I=%d A",I);
13 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 1.41 RESISTANCE

```

1 //Chapter –1, Example 1.41, Page 50
2 //
=====

```

```

3  clc;
4  clear;
5  //INPUT DATA
6  I1=2; //current through R1 in A
7  I3=1.5; //current through R3 in A
8  I5=0.5; //current through R5 in A
9  P2=75; //power dissipated in R2 in W
10 P4=30; //power dissipated in R4 in W
11 V=200; //supply voltage in volts
12 //let the current through R2 and R4 be I2 and I4
    respectively
13 //CALCULATIONS
14 I2=I1-I3; //current through R2 in A
15 I4=I3-I5; //current through R4 in A
16 R2=P2/(I2)^2; //resistance R2 in Ohms
17 R4=P4/(I4)^2; //resistance R4 in Ohms
18 R5=(R4*I4)/(I5); //resistance R5 in Ohms
19 //(R1*I1)+(R2*I2)=200
20 //(R3*I3)+(R4*I4)=(R2*I2)
21 R1=((V-(R2*I2))/I1); //resistance R1 in Ohms
22 R3=((R2*I2)-(R4*I4))/(I3); //resistance R3 in Ohms
23 //OUTPUT
24 mprintf("R1=%d ohms \n R2=%d ohms \n R3=%d ohms \n
    R4=%d ohms \n R5=%d ohms ",R1,R2,R3,R4,R5);
25 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.42 CURRENT

```

1 //Chapter -1, Example 1.42, Page 50
2 //

```

---

```

3 clc;
4 clear;

```

```

5 //INPUT DATA
6 VA=0.2; //voltage across ammeter A in Volts
7 VB=0.3; //voltage across ammeter B in volts
8 I=20; //total current in A
9 //CALCULATIONS
10 RA=VA/I; //resistance through ammeter A in ohms
11 RB=VB/I; //resistance through ammeter B in ohms
12 IA=((RB*I)/(RA+RB)); //current through ammeter A in
    amps
13 IB=I-IA; //current through ammeter B in amps
14 //OUTPUT
15 printf(" IA=%1.0 f Amps \n IB=%d Amps \n ",IA,IB);
16 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.43 RESISTANCE

```

1 //Chapter -1, Example 1.43, Page 51
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 R1=10; //resistance R1 in ohms
7 R2=20; //resistance R2 in ohms
8 R3=40; //resistance R3 in ohms
9 //after certain manipulations the resultant network
    can be evaluated as parallel combinaton of R1,R2,
    R3
10 //CALCULATIONS
11 RAD=1/((1/R1)+(1/R2)+(1/R3)); //resultant resistance
    in Ohms
12 //OUTPUT
13 printf(" Resultant resitance RAD is %1.3 f ohms",RAD)

```



```
14 ;  
    //=====END OF PROGRAM  
    =====
```

---

#### Scilab code Exa 1.44 RESISTANCE

```
1 //Chapter –1, Example 1.44, Page 51  
2 //  
    =====  
  
3 clc;  
4 clear;  
5 //INPUT DATA  
6 V=200;//supply voltage in volts  
7 I=25;//total current in A  
8 P1=1500;//power dissipated in watts  
9 //CALCULATIONS  
10 R1=(V)^2/(P1);//Resistance R1 in Ohms  
11 Reff=(V)/(I);//total effective resistance of R1 and  
    R2 in parallel in Ohms  
12 R2=(Reff*R1)/(R1-Reff);//Resistance R2 in Ohms  
13 //OUTPUT  
14 mprintf("R1=%2.3 f ohms \n R2= %2.3 f ohms",R1,R2);  
15 //=====END OF PROGRAM  
    =====
```

---

#### Scilab code Exa 1.45 RESISTANCE

```
1 //Chapter –1, Example 1.45, Page 52  
2 //  
    =====  
  
3 clc;
```

```

4 clear;
5 //INPUT DATA
6 V=15; //supply voltage in volts
7 VAB=5; //voltage across AB in volts
8 R1=5; //resistance in ohms
9 R2=10; //resistance in ohms
10 R3=10; //resistance in ohms
11 //CALCULATIONS
12 VAC=((R1)/(R1+R3))*V; //Voltage across AC terminals
    in Volts
13 //VBC=(((R)/(R+2))*V)——————eqn(1) by ohm's
    law
14 //VAB=(VAC-((VBC)*(R2-(((R1+R2)*R)/(R+2))))
    —————eqn(2) by ohm's law
15 //solving equation 2 with Vab=5V
16 R=10/10; //resistance R in ohms
17 //OUTPUT
18 mprintf("R=%d ohms",R);
19 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.46 CURRENT

```

1 //Chapter -1, Example 1.46, Page 52
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 Ra=4; //Resistance in ohms
7 Rb=9; //Resistance in ohms
8 Rc=18; //Resistance in ohms
9 Rd=2; //Resistance in ohms
10 Re=7; //Resistance in ohms

```

```

11 Rf=15; //Resistance in ohms
12 V=125; //voltage in volts
13 //CALCULATIONS
14 R1=((Ra)+((Rb*Rc)/(Rc+Rb))); //resistance in branch1
    in ohms
15 R2=((Rd)+(Re)); //resistance in branch2 in ohms
16 Reff=((R1*R2)/(R1+R2))+Rf; //effective resistance in
    ohms
17 I=V/Reff; //current in Rf resistor in Amps
18 I1=(I)*(Rb)/(Rb+R1); //current in resistor Ra in Amps
19 Ix=(I1)*(Rb/(Rb+Rc)) ; //current in resistor Rc in
    Amps
20 V2=(Ix)*(Rc); //voltage across Rc in volts
21 I2=I-I1; //current across Re in Amps
22 P4=(I2)^2*Re; //power dissipated across Re in W
23 //OUTPUT
24 mprintf("current across 15 ohm resistor is %1.2f
    amps \n voltage across 18 ohm resistor is %dV \n
    power dissipated in 7 ohm resistor is %2.1f Watts
    ",I,V2,P4);
25 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.47 CURRENT

```

1 //Chapter -1, Example 1.47, Page 53
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 R1=20; //Resistance in ohms
7 R2=50; //Resistance in ohms
8 R3=30; //Resistance in ohms

```

```

 9 R4=15; // Resistance in ohms
10 V=100; // supply voltage in volts
11 //applying KVL to meshes I and II
12 //R1*(I1)+(R3)*(I1-I2)=V;-----eqn(1)
13 //(R2+R4)*(I2)+(R3)*(I2-I1)=0;-----eqn(2)
14 //solving eqn(1) and eqn(2)
15 //CALCULATIONS
16 [a]=[R2,-R3;-R3,(R3+R4+R2)];
17 [b]=[V;0];
18 [c]=inv(a)*(b);
19 I1=c(1); //current in mesh1 in A
20 I2=c(2); //current in mesh2 in A
21 //OUTPUT
22 mprintf("current across 15 ohm resistor is %1.4f
    amps",I2);
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.48 CURRENT

```

1 //Chapter-1, Example 1.48, Page 53
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 RAB=1; //Resistance across AB in ohms
7 ROB=4; //Resistance across OB in ohms
8 RBC=2; //Resistance across BC in ohms
9 RAC=1.5; //resistance across AC in ohms
10 V=10; // supply voltage in volts
11 //let ROC is R ohms
12 //applying KVL to meshes I,II and III
13 //RAB*(I1)+0+ROB*(I1-I3)=0-----eqn(1)

```

```

14 //RAC*(I2)+ROC*(I2-I3)=0-----eqn(2)
15 //ROB*(I3-I1)+R*(I3-I2)+RBC*I3=10-----eqn(3)
16 //solving eqn(1) we get it as (I2=I1) and applying
    it in eqn(2) we get R as 6 ohms
17 R=6;//Resistance ROC
18 //solving eqn(1),(2)and (3)
19 //CALCULATIONS
20 [a]=[RAB+ROB,0,-ROB;0,(RAC+R),-R;-ROB,-R,(RBC+R+ROB)
    ];
21 [b]=[0;0;10];
22 [c]=inv(a)*(b);
23 I1=c(1);//current in mesh1 in A
24 I2=c(2);//current in mesh2 in A
25 I3=c(3);//current in mesh3 in A
26 I=(I3-I2);//current flowing through R
27 //OUTPUT
28 mprintf("current across resistor R is %1.1f amps",I)
    ;
29 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 1.49 CURRENT

```

1 //Chapter-1, Example 1.49, Page 54
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA
6 R1=5;//Resistance in ohms
7 R2=15;//Resistance in ohms
8 R3=10;//Resistance in ohms
9 R4=8;//resistance in ohms
10 R5=12;//resistance in ohms

```

```

11 V1=4; // supply voltage in volts
12 V2=6; //supply voltage in volts
13 //let currents in mesh I,II and III is I1,I2,I3
    respectively
14 //applying KVL to meshes I,II and III
15 //(R1+R2)*(I1)-R2*(I2)=V1-----eqn(1)
16 //R2*(I1)-(R2+R3+R4)*(I2)+(R4)*(I3)=0-----eqn(2)
17 //R4*(I2)-(R4+R5)=V2-----eqn(3)
18 //solving eqn(1) we get it as (I2=I1) and applying
    it in eqn(2) we get R as 6 ohms
19 R=6; //Resistance ROC
20 //solving eqn(1),(2)and (3)
21 //CALCULATIONS
22 [a]=[R1+R2,-R2,0;R2,-(R2+R3+R4),R4;0,R4,-(R4+R5)];
23 [b]=[V1;0;V2];
24 [c]=inv(a)*(b);
25 I1=c(1); //current in mesh1 in A
26 I2=c(2); //current in mesh2 in A
27 I3=c(3); //current in mesh3 in A
28 I=(I2-I3); //current flowing through R4 in Amps
29 //OUTPUT
30 mprintf("current across 8 ohm resistor is %1.3f amps
    ",I);
31 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.50 CURRENT

```

1 //Chapter-1, Example 1.50, Page 55
2 //
    =====
3 clc;
4 clear;
5 //INPUT DATA

```

```

6 RAB=25; // Resistance in ohms
7 RBC=10; // Resistance in ohms
8 RAD=20; // Resistance in ohms
9 RCD=15; //resistance in ohms
10 RG=50; //resistance of galvanometer in ohms
11 REF=2; //internal resistance in ohms
12 V=25; // supply voltage in volts
13 //let currents in mesh I,II and III is I1 ,I2 ,I3
    respectively
14 //applying KVL to meshes I, II and III
15 // (RAB+RG+RAD) *( I1 ) -(RG) *( I2 ) -(RAD) *( I3 )=0-----eqn
    (1)
16 // -(RG) *( I1 ) -(RG+RCD+RBC) *( I2 ) -(RCD) *( I3 )=0-----
    eqn (2)
17 // -(RAD) *( I1 ) -(RCD) *( I2 ) +(RAD+RCD+REF)=-V-----eqn (3)
18 //solving eqn (1) ,(2) and (3)
19 //CALCULATIONS
20 [a]=[RAB+RG+RAD , -RG , -RAD ; -RG , (RG+RCD+RBC) , -RCD ; -RAD
    , -RCD , (RAD+RCD+REF) ] ;
21 [b]=[0 ; 0 ; -V] ;
22 [c]=inv(a)*(b) ;
23 I1=c(1) ; //current in mesh1 in A
24 I2=c(2) ; //current in mesh2 in A
25 I3=c(3) ; //current in mesh3 in A
26 I=(I1-I2) ; //currentthrough galvanometer in Amps
27 //OUTPUT
28 mprintf(" current across galavanometer is %1.5 f amps"
    ,I) ;
29 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.51 CURRENT

```

1 //Chapter -1, Example 1.51, Page 56
2 //

```

---

```

3  clc;
4  clear;
5  //INPUT DATA
6  V1=100;//source1 voltage in volts
7  V2=50;//source2 voltage in volts
8  R1=10;//Resistance in ohms
9  R2=20;//resistance in ohms
10 R3=30;//resistance in ohms
11 R4=40;//resistance in ohms
12 //let currents in mesh I,II is I1,I2 respectively
13 //applying KVL to meshes I,II
14 //(R1+R3+R4)*(I1)-(R3)*(I2)=V1—————eqn(1)
15 //(R3)*(I1)-(R2+R3)*(I2)=-V2—————eqn(2)
16 //solving eqn(1),(2)
17 //CALCULATIONS
18 [a]=[(R1+R3+R4),-R3;R3,-(R2+R3)];
19 [b]=[V1;-V2];
20 [c]=inv(a)*(b);
21 I1=c(1);//current in mesh1 in A
22 I2=c(2);//current in mesh2 in A
23 I=(I2-I1);//current through R3 in Amps
24 //OUTPUT
25 mprintf("current across 30 ohm resistor is %1.3f
    amps",I);
26 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.52 POWER

```

1 //Chapter -1, Example 1.52, Page 57
2 //

```

---



```

3  clc;
4  clear;
5  //INPUT DATA
6  V1=10; //source1 voltage in volts
7  V2=5; //source2 voltage in volts
8  V3=5; //source3 voltage in volts
9  RAH=2; //Resistance in ohms
10 RAB=3; //resistance in ohms
11 RBE=5; //resistance in ohms
12 REG=5; //resistance in ohms
13 RED=5; //resistance in ohms
14 RBC=7; //resistance in ohms
15 RCD=3; //resistance in ohms
16 RDF=5; //resistance in ohms
17 RHG=5; //resistance in ohms
18 //let currents in mesh I,II ,III is I1 ,I2 ,I3
    respectively
19 //applying KVL to meshes I , II
20 // (RAH+RHG+RAB+RBE+REG) *( I1 ) -(RBE) *( I2 ) -(REG) *( I3 )=
    V1—————eqn (1)
21 // -(RBE) *( I1 ) +(RBC+RCD+RBE+RED) *( I2 ) -(RDF) *( I3 )=-V2
    —————eqn (2)
22 // -(REG) *( I1 ) -(RED) *( I2 ) +(REG+RED+RDF) *( I3 )=-V3
    —————eqn (3)
23 //solving eqn(1) ,(2) and (3)
24 //CALCULATIONS
25 [a]= [(RAH+RHG+RAB+RBE+REG) , -RBE , -REG ; -REG , (RBC+RCD+
    RBE+RED) , -(RDF) ; -REG , -RED , (REG+RED+RDF) ] ;
26 [b]=[V1 ; -V2 ; -V3] ;
27 [c]=inv(a)*(b) ;
28 I1=c(1) ; //current in mesh1 in A
29 I2=c(2) ; //current in mesh2 in A
30 I3=c(3) ; //current in mesh3 in A
31 P1=V1*I1 ; //power output from V1 in W
32 P2=V2*I2 ; //power output from V2 in W
33 P3=V3*I3 ; //power output from V3 in W
34 //OUTPUT
35 mprintf("power output from 10V is %1.1f W\n from 5V

```

```

36      is %1.2fW\n from 5V is %1.2fW ",P1,-P2,-P3);
      //=====END OF PROGRAM
      =====

```

---

### Scilab code Exa 1.54 RESISTANCE

```

1 //Chapter -1, Example 1.54, Page 61
2 //
      =====

3 clc;
4 clear;
5 //INPUT DATA
6 RAC=10; //Resistance in ohms
7 RCD=10; //resistance in ohms
8 RCF=50; //resistance in ohms
9 RDH=50; //resistance in ohms
10 RDF=30; //resistance in ohms
11 RHF=10; //resistance in ohms
12 //using star to delta conversion ,the star point D is
      eliminated
13 //CALCULATIONS
14 RCF1=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RDH); //by
      using star to delta conversion technique
15 RFH=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RCD); //by using
      star to delta conversion technique
16 RHC=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RDF); //by using
      star to delta conversion technique
17 RCF2=(RCF*RCF1)/(RCF+RCF1);
18 RCF=RCF2; //equivalent resistance of RCF in ohms
19 RHF1=(RHF*RFH)/(RHF+RFH);
20 RHF=RHF1; //equivalent resistance of RHF in ohms
21 RAB=(RAC)+(RHC*(RCF+RHF))/(RHC+RCF+RHF); //equivalent
      resistance of AB in ohms
22 //OUTPUT

```

```

23 mprintf("Thus equivalent resistance of AB is %f ohms
    ",RAB);
24 //note:given final answer is wrong in textbook.
    Please check the calculations
25 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.55 RESISTANCE

```

1 //Chapter -1, Example 1.55, Page 62
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 RAB=1;//Resistance in ohms
7 RBE=2;//resistance in ohms
8 RED=3;//resistance in ohms
9 REF=3;//resistance in ohms
10 RDF=3;//resistance in ohms
11 RAD=2;//resistance in ohms
12 RAC=1;//resistance in ohms
13 RBC=1;//resistance in ohms
14 RFC=2;//resistance in ohms
15 //CALCULATIONS
16 //Delta DEF is converted into equivalent star where
    RDN=REN=RFN=1 ohm
17 //series branches of inner star network are added
18 //Star ABCN is converted to equivalent delta
19 RDN=1;
20 REN=RDN;
21 RFN=REN;
22 RAN=RAD+RDN;RBN=RBE+REN;RCN=RFC+RFN
23 RAB1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RCN);//by

```

```

    using star to delta conversion technique
24 RBC1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RAN); //by
    using star to delta conversion technique
25 RCA1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RBN); //by
    using star to delta conversion technique
26 //parallel resistances in each branch are converted
    to single resistance
27 RAB2=(RAB*RAB1)/(RAB+RAB1);
28 RAB=RAB2; //equivalent resistance of RAB in ohms
29 RBC2=(RBC*RBC1)/(RBC+RBC1);
30 RBC=RBC2; //equivalent resistance of RBC in ohms
31 RCA2=(RAC*RCA1)/(RAC+RCA1);
32 RCA3=((RCA2)*(RAB+RBC))/(RBC+RAB+RCA2);
33 RCA=RCA3;
34 //OUTPUT
35 printf("Thus equivalent resistance of CA is %1.1f
    ohms",RCA);
36 //TO FIND EQUIVALENT RESISTANCE BETWEEN DF
37 //

```

---

```

38 //node A is eliminated using star to delta
    conversion
39 RBC=(RAB*RAD)+(RAD*RAC)+(RAC*RAB)/(RAD); //by using
    star to delta conversion technique
40 RCD=(RAB*RAD)+(RAD*RAC)+(RAC*RAB)/(RAB); //by using
    star to delta conversion technique
41 //node C is eliminated using star to delta
    conversion
42 RDB=(0.72*5)+(5*2)+(2*0.72)/2;
43 RBF1=(0.72*5)+(5*2)+(2*0.72)/5;
44 RFD=(0.72*5)+(5*2)+(2*0.72)/0.72;
45 //parallel branches between nodes B and D and nodes
    D and F are reduced as
46 RBD=(RDB*5)/(RDB+5);
47 RDF=(RFD*3)/(RFD+3);
48 //node E is eliminated using star to delta
    conversion technique

```

```

49 RBF=((2*3)+(3*3)+(3*2))/3;
50 RFD=((2*3)+(3*3)+(3*2))/2;
51 RDB=((2*3)+(3*3)+(3*2))/3;
52 RDF1=4.2; //(R'=RDB+RDF)
53 RDF=((RDF1)*(RDF1/2))/(RDF1+(RDF1/2));
54 //OUTPUT
55 mprintf("\n Thus equivalent resistance of DF is %1.1
        f ohms",RDF);
56 //=====END OF PROGRAM
        =====

```

---

#### Scilab code Exa 1.56 CURRENT

```

1 //Chapter-1, Example 1.56, Page 66
2 //
=====
3 clc;
4 clear;
5 //INPUT DATA
6 RAB=6; //Resistance in ohms
7 RBC=3; //resistance in ohms
8 RBD=4; //resistance in ohms
9 V1=25; //source voltage in volts
10 V2=45; //source voltage in volts
11 //CALCULATIONS
12 //applying kirchoff's current law at node B
13 //-I1-I2+I3=0
14 //I1=(V1-VB)/RAB
15 //I2=(V3-VB)/RBC
16 //I3=VB/RBD
17 VB=((V1/RAB)+(V2/RBC))/((1/RAB)+(1/RBC)+(1/RBD));
18 I1=(V1-VB)/(RAB); //current across AB
19 I2=(V2-VB)/(RBC); //current across BC
20 I3=(VB)/(RBD); //current across BD

```

```

21 //OUTPUT
22 mprintf("Thus currents I1,I2,I3 are %1.1f A %1.2f A
        %1.1f A",I1,I2,I3);
23 //=====END OF PROGRAM
        =====

```

---

### Scilab code Exa 1.57 VOLTAGE

```

1 //Chapter-1, Example 1.57, Page 67
2 //
=====

3 clc;
4 clear;
5 //INPUT DATA
6 I1=25;//current source in A
7 I2=6;//current source in A
8 I3=5;//current source in A
9 RAB=5;//Resistance in ohms
10 RAC=10;//Resistance in ohms
11 RBC=2;//Resistance in ohms
12 //let currents across AC and BC and AB are Ix,Iy and
    Iz respectively
13 //applying kirchoff's current law at node A
14 // -I1+Ix+I3+Iz=0-----eqn(1)
15 //applying kirchoff's current law at node B
16 // -Iz-I3+Iy+I2=0-----eqn(2)
17 //CALCULATIONS
18 [a]=[((1/RAC)+(1/RAB)),(-1/RAB);(-1/RAB),((1/RAB)
        +(1/RBC))];
19 [b]=[20;-1];
20 [c]=inv(a)*(b)
21 VA=c(1);//voltage at node A
22 VB=c(2);//voltage at node B
23 //OUTPUT

```

```

24 mprintf("Thus voltages at node A and B are %2.1f V
    and %2.1f V",-VA,VB);
25 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.58 RESISTANCE

```

1 //Chapter -1, Example 1.58, Page 68
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 RAB=1; //Resistance in ohms
7 RAD=1; //Resistance in ohms
8 RDC=2; //Resistance in ohms
9 RCB=1; //Resistance in ohms
10 RAC=1; //Resistance in ohms
11 //delta DAC has been converted to star DAC where RDN
    =0.5 ohms, RNA=0.25 ohms, RNC=0.5 ohms
12 //CALCULATIONS
13 RDN=0.5;
14 RNA=0.25;
15 RNC=0.5
16 RBD=((RDN)+(((RNA+RAB)*(RNC+RCB))/(RNA+RAB+RNC+RCB))
    );//equivalent resistance across BD
17 //OUTPUT
18 mprintf("Thus equivalent resistance across BD is %1
    .2f ohms",RBD);
19 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 1.59 RESISTANCE

```
1 //Chapter-1, Example 1.59, Page 69
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 RAB=9; // Resistance in ohms
7 RBC=1; // Resistance in ohms
8 RCA=1.5; // Resistance in ohms
9 RAD=6; // Resistance in ohms
10 RBD=4; // Resistance in ohms
11 RCD=3; // Resistance in ohms
12 //star ABC has been converted to delta AnBnCn where
    RABn=18 ohms,RBCn=9 ohms,RCAn=13.5 ohms
13 //CALCULATIONS
14 RABn=18;
15 RBCn=9;
16 RCAn=13.5;
17 RAB1=((RAB*RABn)/(RAB+RABn)); //equivalent resistance
    across AB
18 RBC1=((RBC*RBCn)/(RBC+RBCn)); //equivalent resistance
    across BC
19 RAC1=((RCA*RCAn)/(RCA+RCAn)); //equivalent resistance
    across AC
20 //there are two parallel paths across points A and B
    .
21 //(a)one directly from A to B having a resistance of
    6 ohms and
22 //(b)The other via C having a total resistance
23 RBA=((RBC1+RAC1)*(RAB1))/(RBC1+RAC1+RAB1); //final
    equivalent resistance across AB
24 RCB=((RAC1+RAB1)*(RBC1))/(RAC1+RAB1+RBC1); //final
    equivalent resistance across BC
25 RCA=((RAB1+RBC1)*(RAC1))/(RAB1+RBC1+RAC1); //final
    equivalent resistance across AC
```



```
26 //OUTPUT
27 mprintf("Thus final equivalent resistance across AB,
    BC and CA are %1.2f ohms,%1.2f ohms,%1.2f ohms",
    RBA,RCB,RCA);
28 //note:answer given for RCA is wrong.Please check
    the calculations
29 //=====END OF PROGRAM
    =====
```

---

## Chapter 2

# MAGNETIC CIRCUITS

Scilab code Exa 2.1 MMF

```
1 //Chapter -2, Example 2.1, Page 89
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 N=2000;//no of turns
7 I=10;//current in A
8 Rm=25;//mean radius in cm
9 d=6;//diameter of each turn in cm
10 //CALCULATIONS
11 MMF=N*I;//magneto motive force in A
12 l=2*%pi*(Rm/100);//circumference of coli in m
13 u=(4*%pi*10^-7);//permeability (U=Ur*U0)
14 a=(%pi*d*d*10^-4)/4;
15 reluctance=(1/(a*u));//reluctance in At/Wb
16 flux=(MMF)/(reluctance);//flux in Wb
17 fluxdensity=(flux/a);//flux density in Wb/m^2 or
    tesla
18 //OUTPUT
```

```

19 mprintf("Thus MMF, flux , flux density  are %d A, %g Wb
    ,%g Wb/m^2 or Tesla respectively ",MMF,flux,
    fluxdensity);
20 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 2.2 FLUX DENSITY

```

1 //Chapter -2, Example 2.2, Page 90
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 phi=5*10^-2;//flux in wb
7 a=0.2;//area of cross-section in m^2
8 lg=1.2*10^-2;//length of air gap in m
9 ur=1;//permeability
10 u=ur*4*%pi*10^-7;//permeability
11 //CALCULATIONS
12 B=(phi/a);//flux density in wb/sq.m
13 H=(B/(4*%pi*10^-7*ur));//magnetic flux density in A/
    m
14 S=lg/(a*u);//reluctance of air gap in A/wb
15 permeance=1/S;//permenace in A/wb
16 mmf_in_airgap=phi*S;//mmf in A
17 //OUTPUT
18 mprintf("Thus B,H,S,permeance,MMF in air gap are %1
    .2f Wb/sq.m, %g A/m ,%f A/wb ,%g Wb/A ,%d A
    respectively ",B,H,S,permeance,mmf_in_airgap);
19 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 2.3 PERMEABILITY

```
1 //Chapter -2, Example 2.3, Page 90
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 phi=0.1*10^-3; //flux in wb
7 a=1.7*10^-4; //area of cross-section in m^2
8 lg=0.5*10^-3; //length of air gap in m
9 Rm=15/2; //radius of ring in cm
10 u0=4*%pi*10^-7; //permeability in free space in henry
    /m
11 N=1500; //no of turns of ring
12 //CALCULATIONS
13 B=(phi/a); //flux density in wb/sq.m
14 H=(B/(4*%pi*10^-7)); //magnetic flux density in A/m
15 ampere_turns_provided_fo=H*lg;
16 total_ampere_turns_provi=N*1;
17 Available_for_iron_path=N-(H*lg);
18 length_of_iron_path=(2*Rm*%pi*10^-2)-(lg); //length
    of iron path in m
19 H_for_iron_path=((N-(H*lg)))/(length_of_iron_path);
20 ur=(B/(u0*H_for_iron_path)); //relative permeability
    of iron
21 //OUTPUT
22 mprintf("Thus relative permeability of iron is %d",
    ur);
23 //=====END OF PROGRAM


---


```

### Scilab code Exa 2.4 CURRENT

```
1 //Chapter –2, Example 2.4, Page 91
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 li=0.5; //iron path length in m
7 lg=10-3; //length of air gap in m
8 phi=0.9*10-3; //flux in wb
9 a=6.66*10-4; //area of cross-section of iron in m2
10 N=400; //no of turns
11 //CALCULATIONS
12 B=(phi/a); //flux density in wb/sq.m
13 Hg=(B/(4*%pi*10-7)); //magnetic flux density in A/m
14 AT_required=Hg*lg; //AT required for air path
15 Hi=1000; //magnetic flux density in A/m
16 AT_required_for_iron_pat=Hi*li;
17 total_AT_required=(Hg*lg)+(Hi*li);
18 I=((Hg*lg)+(Hi*li))/(N);
19 //OUTPUT
20 mprintf("Thus exciting current required is %1.2f A",
    I);
21 //=====END OF PROGRAM


---


```

### Scilab code Exa 2.5 CURRENT

```
1 //Chapter –2, Example 2.5, Page 92
```

```

2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 r=0.01;//radius in m
7 lg=10^-3;//length of air gap in m
8 Rm=(30/2)*10^-2;//mean radius in m
9 ur=800;//relative permeability of iron
10 ur2=1;//relative permeability of air gap
11 N=250;//no of turns
12 phi=20000*10^-8;//flux in Wb
13 u0=4*%pi*10^-7;//permeability in free space
14 a=%pi*(r)^2;//area of cross-section in m
15 leakage_factor=1.1
16 //CALCULATIONS
17 Reluctance_of_air_gap=(lg/(u0*ur2*a));//reluctance
    of air gap in A/wb
18 li=(%pi*(2*r)-(lg));//length of iron path in m
19 Reluctance_of_iron_path=((%pi*0.3)-(lg))/(4*%pi
    *10^-7*800*a);//in A/wb
20 total_reluctance=Reluctance_of_air_gap+
    Reluctance_of_iron_path;//in A/wb
21 MMF=phi*total_reluctance;//in Ampere turns
22 current_required=(MMF)/(N);//in A
23 //OUTPUT
24 mprintf("Thus current required is %1.2f A \n",
    current_required);
25 //Including leakage
26 //CALCULATIONS
27 MMF_of_airgap=phi*Reluctance_of_air_gap;//in A/wb
28 Total_flux_in_ironpath=leakage_factor*phi;//in Wb
29 MMF_of_ironpath=Total_flux_in_ironpath*
    Reluctance_of_iron_path;//in A
30 Total_MMF=MMF_of_ironpath+MMF_of_airgap;//in A/wb
31 current_required2=Total_MMF/(N);//in A
32 //OUTPUT

```

```
33 mprintf("Thus current required is %1.3f A",  
    current_required2);
```

---

### Scilab code Exa 2.6 CURRENT

```
1 //Chapter –2, Example 2.6, Page 93  
2 //  
  
3 clc;  
4 clear;  
5 //INPUT DATA  
6 l1=0.1; //length in m  
7 l2=0.18; //length in m  
8 l3=0.18; //length in m  
9 lg=1*10^-3; //airgap length in mm  
10 a1=6.25*10^-4; //area in m^2  
11 a2=3*10^-4; //area in m^2  
12 ur=800; //relative permeability of iron path  
13 ur2=1; //relative permeability in free space  
14 u0=4*pi*10^-7  
15 N=600;  
16 phi=10^-4; //airgap flux in Wb  
17 //CALCULATIONS  
18 //for the airgap  
19 Bg=(phi/(a1)); //fluxdensity in Tesla  
20 Hg=(Bg/(u0*ur2)); //magnetising force in A/m  
21 MMF1=Hg*lg; //in A  
22 //for path I1  
23 B1=0.16; // flux density in tesla  
24 H1=(B1/(ur*u0)); //magnetising force in A/m  
25 MMF2=H1*l1; //in A  
26 //since paths l2 and l3 are similar, the total flux  
    divide equally between these two paths. Since  
    these paths are in parallel, consider only one of
```

```

        them
27 //for path l2
28 flux=50*10^-6; //flux in wb
29 B2=(flux/a2); //fluxdensity in tesla
30 H2=(B2/(ur*u0)); //magnetising force in A/m
31 MMF3=H2*l2; //in A
32 totalmmf=MMF1+MMF2+MMF3; //in A
33 I=(totalmmf/N); //current required in A
34 //OUTPUT
35 mprintf("Thus current required is %1.3 f A",I);
36 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 2.7 CURRENT

```

1 //Chapter -2, Example 2.7, Page 95
2 //
=====

3 clc;
4 clear;
5 //INPUT DATA
6 Dm=0.1 //diameter in m
7 a=10^-3; //area of cross-section in m^2
8 N=150; //no of turns
9 ur=800; //permeability of iron ring
10 B=0.1; //in Wb/m^2
11 u0=4*pi*10^-7; //permeability of free space
12 //CALCULATIONS
13 S=(pi*Dm)/(a*ur*u0); //reluctance
14 I=(B*a*S)/(N); //current in A
15 //OUTPUT
16 mprintf("Thus current is %f A",I);
17 //=====END OF PROGRAM
=====

```



---

**Scilab code Exa 2.8 RELUCTANCE**

```
1 //Chapter -2, Example 2.8, Page 95
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 l=0.3; //length in m
7 d=1.5*10^-2; //diameter in m
8 N=900; //no of turns
9 ur=1; //relative permeability in free space
10 u0=4*%pi*10^-7; //permeability in free space
11 I=5; //current in A
12 //CALCULATIONS
13 a=(%pi*(d)^2/4); //in m^2
14 S=(1)/(a*ur*u0); //reluctance
15 //OUTPUT
16 mprintf("Thus reluctance is %f A/wb",S);
17 //=====END OF PROGRAM


---


```

**Scilab code Exa 2.9 MMF**

```
1 //Chapter -2, Example 2.9, Page 95
2 //


---


3 clc;
4 clear;
```

```

5 //INPUT DATA
6 lg=10^-3; //length of air gap in m
7 B=0.9; //flux density in wb/m^2
8 li=0.3; //length of ironpath in m
9 Hi=800; //magnetic flux density in AT/m
10 u0=4*pi*10^-7; //permeabilty in free space
11 //CALCULATIONS
12 //for iron path
13 MMF_required1=Hi*li; //magnetic motive force in AT
14 //for air gap
15 MMF_required2=(B/u0)*lg; //magnetic motive force in
    AT
16 Totalmmf=MMF_required1+MMF_required2
17 //OUTPUT
18 mprintf("Thus total MMF required is %d AT",Totalmmf)
    ;
19 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 2.10 FLUX DENSITY

```

1 //Chapter -2, Example 2.10, Page 96
2 //
    =====

3 clc;
4 clear;
5 //INPUT DATA
6 li=0.5; //length of iron ring mean length in m
7 N=220; //no of turns
8 I=1.2; //current in A
9 lg=1.2*10^-3; //length of airgap in m
10 ur=350; //relative permeability of iron
11 u0=4*pi*10^-7; //permeability in free space
12 //CALCULATIONS

```

```
13 MMF_produced=N*I;
14 Si=li/(u0*ur); //reluctance of iron path
15 Sg=lg/(u0); //reluctance of air gap
16 S=Si+Sg; //total reluctance
17 Flux_density=(MMF_produced)/(S);
18 //OUTPUT
19 mprintf("Thus fluxdensity is %1.3f Wb/m^2",
    Flux_density);
20 //=====END OF PROGRAM
    =====
```

---

# Chapter 3

## ELECTROMAGNETIC INDUCTION

Scilab code Exa 3.1 VOLTAGE

```
1 //Chapter –3, Example 3.1, Page 109
2 //


---


3 clc;
4 clear;
5 //INPUT DATA
6 P=4;//no of poles
7 N1=500;//no of turns per pole
8 phi=0.02;//magnetic flux in wb/pole
9 t=0.02;//time in sec
10 rphi=0.002;//residual flux in wb/pole
11
12 //CALCULATIONS
13 N=P*N1;//total no of turns
14 di=P*phi;//total initial flux in wb
15 dR=P*rphi;//total residual flux in wb
16 dphi=di-dR;//change in flux in wb
17 dt=0.02;//time of opening the circuit in sec
```

```

18 E=N*(dphi/dt); //induced emf in volts
19 //OUTPUT
20 mprintf("Thus the average voltage that is induced
    across field terminals is %4.0f volts \n",E);
21 mprintf("The direction of this emf is the same as
    that of the original direction of the exciting
    current");
22
23 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 3.2 AVERAGE EMF

```

1 //Chapter-3, Example 3.2, Page 109
2 //
    =====

3 clc
4 clear
5
6 //INPUT DATA
7 R=150; //Resistance of the coil in ohms
8 phi1=0.1; //magnetic flux in milli webers
9 N=500; //no of turns
10 Rgal=450; //resistance of galvanometer in ohms
11 dt=0.1; //time in sec required to move coil from
    given field(m) to another field (m2)
12 phi2=0.3; //magnetic flux of new field in milli
    webers
13 //CALCULATIONS
14 dphi=phi2-phi1; //change of flux in milli webers
15 E=N*(dphi/dt)*10^-3; //average induced emf in volts(V
    )
16 I=E/(R+Rgal); //average induced current in coil in
    amperes(A)

```

```

17
18 //OUTPUT
19 mprintf('Average induced emf and current are %1.0f V
    and %1.4f A',E,I);
20
21 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 3.3 FORCE

```

1 //Chapter –3, Example 3.3, Page 110
2 //
    =====

3 clc
4 clear
5
6 //INPUT DATA
7 l=0.1;//conductor length (10 cm)=(0.1 m)
8 I=60;//current in amperes (A)
9 H=1000;//magnetic field strength in ampere/metre (A/
    m)
10 v=1;//conductor speed in metre/second(m/s)
11 u0=4*pi*10^-7;//permeability in free space in henry
    /m
12 //CALCULATIONS
13 B=u0*1000;//magnetic flux density in (wb/m^2)
14 F=B*I*l;//force in Newtons(N)
15 P=F*v;//power in watt
16 E=B*l*v;//emf induced in conductor
17 //OUTPUT
18 mprintf("The force acting on conductor %1.4f N \n",F
    );
19 mprintf("The mechanical power to move this conductor
    is %1.4f watt \n",P);

```

```

20 mprintf("The induced emf in conductor is %1.5f V \n"
    ,E);
21
22 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 3.4 INDUCTANCE

```

1 //Chapter-3, Example 3.4, Page 110
2 //
    =====

3 clc
4 clear
5
6 //INPUT DATA
7 l=0.3;//mean length of toroidal coil in meters (30cm
    =0.3m)
8 N=480;//no of turns of coil
9 a=5*10^-4;//cross sectional area in metres (1 cm
    ^2=10^-4 m^2)
10 I=4;//current in amps
11 dt=60*10^-3;//time in sec
12 u0=4*pi*10^-7;//permeability in free space in henry
    /m
13 ur=1;//relative permeability for air
14 //CALCULATIONS
15 L=(u0*ur*a*N*N)/(l);//inductance of coli in henry
16 di=I-(-I);//change in current in amps
17 E=L*(di/dt);//average induced emf
18 //OUTPUT
19 mprintf('The inductance of the coil is %1.6f H \n',L
    )
20 mprintf('average induced emf is %1.3f V \n',E)
21

```

```
22 //=====END OF PROGRAM
```

---

### Scilab code Exa 3.5 MUTUAL INDUCTANCE

```
1 //Chapter -3, Example 3.5, Page 111
2
3 //
  =====

4 clc
5 clear
6 //INPUT DATA
7 L1=0.25;//self inductance of coil in henry(H)
8 N1=500;//no of turns of coil 1
9 N2=10500;//no of turns of coil 2
10 phi2=0.6*L1;//60 % of flux of first coil(m1) is
    linked with second coil(m2)
11 z=100;//rate of change of current(dii/dt) in A/sec
12
13 //CALCULATIONS
14 x=L1/N1;//flux/ampere in first coil(phi1/I1)
15 y=0.6*(x);//flux linking the second coil(phi2/I1)
16 M=N2*(y);//mutual inductance between the two coils
    in H
17 E=M*(z);//induced emf in V
18 //OUTPUT
19 mprintf("Thus the mutual inductance between two
    coils is %1.2f H \n",M);
20 mprintf("The induced emf in second coil when current
    changes in first coil is %3.0f V \n",E);
21
22 //=====END OF PROGRAM
```

---



### Scilab code Exa 3.6 INDUCTANCE

```
1 //Chapter –3, Example 3.6 , Page 111
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 N1=250; //no of turns in a coil
7 I1=2; //current in coil in A
8 phi1=0.3; //flux in coil in wb
9 dt=2 //time in millisec
10 Em2=63.75 //induced voltage in V
11 K=0.75
12 //CALCULATIONS
13 L1=N1*(phi1/I1); //self inductance of first coil in H
14 M=Em2*(dt/I1); //mutual inductance of two coils in H
15 L2=((Em2/K)^2)/(L1); //self inductance of second coil
    in H
16 phi2=K*phi1; //flux in second coil in wb
17 N2=(Em2*dt)/phi2; //no of turns in second coil
18 //OUTPUT
19 mprintf("Thus the self inductance of first coil is
    %2.1f mH \n",L1);
20 mprintf("mutual inductance of two coils %2.2f mH \n"
    ,M);
21 mprintf("self inductance of second coil %4.0f mH \n"
    ,L2);
22 mprintf("no of turns in second coil %3.0f turns \n",
    N2);
23 //note:the answer given for N2 in textbook is wrong
    .please check the calculations
24
```

```
25 //=====END OF PROGRAM
```

---

### Scilab code Exa 3.7 EMF

```
1 //Chapter –3, Example 3.7, Page 112
2 //
   =====
3 clc
4 clear
5 //INPUT DATA
6 l=1;//length of wire in m
7 v=50;//velocity in m/sec
8 B=1;//magnetic flux density in wb/m2
9 theta1=90;//the angle of conductor in degrees to the
   field in case 1
10 theta2=30;//the angle of conductor in degrees to the
   field in case 2
11 //CALCULATIONS
12 E1=B*l*v*sin (theta1*%pi/180);//emf induced in
   conductor in case 1(1 degree =3.14/180 radians)
13 E2=B*l*v*sin ((360+theta2)*%pi/180);//emf induced in
   conductor in case 2(1 degree =3.14/180 radians)
14 //OUTPUT
15 mprintf("Thus the emf induced in case 1 is %2.0 f
   volts \n",E1);
16 mprintf("Thus the emf induced in case 2 is %2.0 f
   volts \n",E2);
17 //note:convert angle in degrees to radians and
   compute it .
18 //=====END OF PROGRAM
```

---

### Scilab code Exa 3.8 AVERAGE INDUCTANCE

```
1 //Chapter -3, Example 3.8, Page 112
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 N=1000; //no of turns in a coil
7 a=10*10-4; //crosssectional area in m2
8 i1=4.2; //current in A in case 1
9 i2=9.2; //current in A in case 2
10 B1=1; //flux density in wb/m2 when current is i1
11 B2=1.42; //flux density in wb/m2 when current is
12 dt=0.05; //time in sec where current reduces from 9.2
    A to 4.2A
13 //CALCULATIONS
14 db=(B2-B1) //difference in flux densities
15 di=(i2-i1); //difference in currents
16 di1=(i1-i2); //difference in currents
17 L=N*a*(db)/di; //average inductance between the
    limits in H
18 E=-(L*di1/dt); //emf induced
19 //OUTPUT
20 mprintf("Thus the average inductance between the
    limits is %1.3f H \n",L);
21 mprintf("emf induced is %1.1f volts\n",E);
22
23 //=====END OF PROGRAM


---


```

### Scilab code Exa 3.9 MUTUAL INDUCTANCE

```
1 //Chapter-3, Example 3.9, Page 113
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 N1=1600;//no of turns of solenoid
7 l=0.5;//length of wire of solenoid in m
8 N2=600;//no of turns of second coil
9 a=18*10-4;//area of second coil in m2
10 u0=4*%pi*10-7;//permeability in free space
11 z=300;//rate of change of current(di1/dt) in A/sec
12 //CALCULATIONS
13 B=(u0*N1)/(l);//flux density in solenoid
14 M=(B*a*N2);//mutual inductance in mH
15 E=M*(z);//voltage induced
16 //OUTPUT
17 mprintf("Thus the mutual inductance is %f H \n",M);
18 mprintf("Thus the voltage induced is %f V \n",E);
19 //note:answer given for voltage in text book is
    wrong.please check the calculations
20 //=====END OF PROGRAM
    =====
```

---

### Scilab code Exa 3.10 MUTUAL INDUCTANCE

```
1 //Chapter-3, Example 3.10, Page 113
2 //


---


3 clc
4 clear
```

```

5 //INPUT DATA
6 NA=15000;//no of turns in coil A
7 IA=6;//current in coil A in Amp(A)
8 phiA=0.05*10^-3;//flux in coil A in wb
9 NB=12000;//no of turns in coil B
10 IB=6;//current in coil B in Amp(A)
11 phiB=0.08*10^-3;//flux in coil B in wb
12 phiAB=0.55*0.05*10^-3;//mutual flux in wb
13 //CALCULATIONS
14 LA=phiA*NA/IA;//self inductance of coil A in H
15 LB=phiB*Nb/IB;//self inductance of coil B in H
16 LAB=phiAB*Nb/IB;//mutual inductance of coils in H
17 K=LAB/sqrt(LA*LB);//coefficient of coupling
18 //OUTPUT
19 mprintf("Thus the self inductance of coil A is %1.3
        f H\n",LA);
20 mprintf("Thus the self inductance of coil B is %1.2 f
        H \n",LB);
21 mprintf("Thus the mutual inductance of coils is %1.3
        f H \n",LAB);
22 mprintf("Thus the coefficient of coupling is %1.3 f \
        n",K)
23
24 //=====END OF PROGRAM
        =====

```

---

# Chapter 4

## AC FUNDAMENTALS

Scilab code Exa 4.1 FORM FACTOR

```
1 //Chapter -4, Example 4.1, Page 126
2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 //for WAVEFORM 1
7 //Average Value
8 b1=2;
9 h1=5;
10 area1=0.5*b1*h1;//area under one complete cycle(area
    of a triangle)
11 av0=area1/2;//average value
12 //rms value
13 area2=0.33*(h1)^2*b1;
14 rms=sqrt(area2/b1);//rms value
15 //form factor
16 ff=rms/av0;//form factor
17 //peak factor
18 Kp=h1/rms;//peak factor
```

```

19 mprintf("WAVEFORM 1\n");
20 mprintf(" average value=%1.1 f amps,rms value=%1.3 f
    amps,formfactor=%1.3 f ,peak factor=%1.3 f\n",av0,
    rms,ff,Kp);
21 //for WAVEFORM 2
22 //Average Value
23 T=1;//assuming time period is 1
24 h2=100;
25 h3=-50;
26 area3=(h2+h3)*(T/2);//area under one complete cycle(
    area of a rectangle)
27 av=area3/T;//average value
28 //rms value
29 area_under_squared_curve=((h2)^2+(h3)^2)*(T/2);
30 rms1=sqrt(area_under_squared_curve/T);//rms value
31 //form factor
32 ff1=rms1/av;//form factor
33 //peak factor
34 Kp1=h2/rms1;//peak factor
35 mprintf("WAVEFORM 2\n");
36 mprintf(" average value=%d volts ,rms value=%2.3 f volt
    ,formfactor=%1.2 f ,peak factor=%1.2 f\n",av,rms1,
    ff1,Kp1);
37 //for WAVEFORM 3
38 //Average Value
39 Vm=1;//assuming mean voltage is 1
40 a1=0.5*Vm*(%pi/3);//area of the triangle from 0 to (
    pi/3)
41 a2=Vm*(%pi/3);//area of the rectangle for period (pi
    /3) to (2*pi/3)
42 a3=0.5*Vm*(%pi/3);//area of the triangle from (2*pi
    /3) to pi
43 a=a1+a2+a3;
44 av2=(a/%pi);//average value
45 //rms value
46 area_under_squared_curv2=((Vm)^2*(%pi/3)*(5/3))
47 rms2=sqrt(area_under_squared_curv2/(%pi));//rms
    value

```

```

48 //form factor
49 ff2=rms2/av2;//form factor
50 //peak factor
51 Kp2=Vm/rms2;//peak factor
52 mprintf("WAVEFORM 3\n");
53 mprintf("average value=%1.3f volts ,rms value=%1.3f
    volt ,formfactor=%1.2f ,peak factor=%1.3f\n",av2,
    rms2,ff2,Kp2);
54 //for WAVEFORM 4
55 //Average Value
56 T2=1;//let timeperiod=1
57 av3=(100*(T2/2))/(T2/2);//average
58 //rms value
59 area_under_squared_curv3=((100)^2*(T2/2));
60 rms3=sqrt((area_under_squared_curv3)/(T2/2));//rms
    value
61 //form factor
62 ff3=rms3/av3;//form factor
63 //peak factor
64 Kp3=100/rms3;//peak factor
65 mprintf("WAVEFORM 4\n");
66 mprintf("average value=%d volts ,rms value=%d volt ,
    formfactor=%d ,peak factor=%d\n",av3,rms3,ff3,Kp3
    );
67 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.2 FORM FACTOR

```

1 //Chapter -4, Example 4.2, Page 130
2 //
    =====
3 clc
4 clear

```



```

5 //CALCULATIONS
6 //for halfwave rectifier
7 Im=1;//assume peak value is 1
8 //for (0 to pi) value is (Im*sin(theta)) for (pi to
   2*pi) value is 0
9 function y1=f1(x),y1=(Im^2)*(sin(x))^2, endfunction
10 a1=(intg(0,%pi,f1));
11 a=(a1)/(2*%pi);//mean square value
12 rms=sqrt(a);//rms value
13 function y3=f3(x),y3=(Im)*(sin(x)), endfunction
14 a3=(intg(0,%pi,f3));
15 av=a3/(2*(%pi));//average value
16 ff=rms/av;//form factor
17 pf=Im/rms;//peak factor
18 mprintf("for half wave rectifier\n");
19 mprintf("form factor=%1.2f,peak factor=%d\n",ff,pf);
20 //for fullwave rectifier
21 function y4=f4(x),y4=(Im^2)*(sin(x))^2, endfunction
22 a4=(intg(0,%pi,f4));
23 a4=a4/(%pi);
24 rms2=sqrt(a4);//rms value
25 function y5=f5(x),y5=(Im)*(sin(x)), endfunction
26 av2=(intg(0,%pi,f5))/(%pi);//average value
27 ff2=rms2/av2;//form factor
28 pf2=Im/rms2;//peak factor
29 mprintf("for full wave rectifier\n");
30 mprintf("form factor=%1.2f,peak factor=%1.2f",ff2,
   pf2);
31 //=====END OF PROGRAM
   =====

```

---

### Scilab code Exa 4.3 RMS

```

1 //Chapter -4, Example 4.3, Page 132
2 //

```

---

```

3  clc
4  clear
5  //CALCULATIONS
6  v1=0; v2=5; v3=10; v4=20; v5=50; v6=60; v7=50; v8=20; v9=10;
   v10=5; v11=0; v12=-5; v13=-10;
7  Vm=60;
8  V=((v1^2)+(v2^2)+(v3^2)+(v4^2)+(v5^2)+(v6^2)+(v7^2)
   +(v8^2)+(v9^2)+(v10^2))
9  V=sqrt(V/10);
10 Vav=(v1+v2+v3+v4+v5+v6+v7+v8+v9+v10)/10; //average
   value
11 Kf=V/Vav; //form factor
12 Kp=Vm/V; //peak factor
13 rms2=Vm/(sqrt(2)); //rms voltage value with the same
   peak value
14 mprintf("rms1 =%2.2f volts\n average value=%d volts
   \n form factor= %2.2f \n peak factor= %1.3f \n
   rms2 value is %2.2f volts",V,Vav,Kf,Kp,rms2);
15 //=====END OF PROGRAM
   =====

```

---

#### Scilab code Exa 4.4 TIME

```

1  //Chapter -4, Example 4.4, Page 133
2  //

```

---

```

3  clc
4  clear
5  //CALCULATIONS
6  f=60;
7  Im=120;
8  i=96;

```

```

9 t=asin(i/Im)/(2*pi*60);
10 mprintf("time is %1.5f sec",t)
11 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.5 RATE OF CHANGE OF CURRENT

```

1 //Chapter -4, Example 4.5, Page 133
2 //
    =====

3 clc
4 clear
5 funcprot(0)
6 //CALCULATIONS
7 Im=100;//current in amps
8 f=50;//freq in hz
9 w=2*pi*50;//angular freq in rad/sec
10 //at t=0.0025
11 function f=myfun(t)
12     f=Im*sin(w*t(1));
13 endfunction
14 t=[0.0025];
15 g=numdiff(myfun,t)//by using numdiff function the
    calculated value will defer to observed value by
    15
16 //at t= 0.005
17 function f1=myfun(t1)
18     f1=Im*sin(w*t1(1));
19 endfunction
20 t1=[0.005];
21 g1=numdiff(myfun,t1);
22 //at t= 0.01
23 function f2=myfun(t2);
24     f2=Im*sin(w*t2(1));

```

```

25 endfunction
26 t2=[0.01];
27 g2=numdiff(myfun,t2);
28 mprintf("rate of change of current at t=0.025,t
           =0.005,t=0.01 sec are %d A/sec %d A/sec %d A/sec
           respectively",g,g1,g2);
29 //=====END OF PROGRAM
           =====

```

---

#### Scilab code Exa 4.6 EMF

```

1 //Chapter-4, Example 4.6, Page 134
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 N=200;//no of turns
7 a=250;//area of cross-section in sq.cm
8 Bm=0.5;//magnetic field strength in Tesla
9 speed=1200;//in r.p.m
10 //CALCULATIONS
11 w=2*pi*(speed/60);//angular freq in rad/sec
12 phi=Bm*a*10^-4;//area taken in sq.m
13 Em=N*w*phi;//maximum value of induced Emf
14 mprintf("maximum value of induced Emf is %d volts\n"
           ,Em);
15 //equation for instantaneous induced emf is e=Em*sin
           (w*t)
16 //when plane of coil is parallel to field ,theta is
           90 degrees
17 e1=Em*sin(pi/2);//converted degrees to radians
18 mprintf("when plane of coil is parallel to field ,
           induced Emf is %d volts\n",e1);

```

```

19 //when plane of coil is parallel to field ,theta is
    0 degrees
20 e2=Em*sin(0);
21 mprintf("when plane of coil is perpendicular to
    field , induced Emf is %d volts\n",e2);
22 //when plane of coli is inclined at 45 degrees to
    the field
23 e3=Em*sin(%pi/4);
24 mprintf("when plane of coil is at 45 degrees to
    field , induced Emf is %d volts\n",e3);
25 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.7 RMS

```

1 //Chapter -4, Example 4.7, Page 135
2 //
    =====
3 clc
4 clear
5 //INPUT DATA
6 I=10;//direct current in A
7 Im=10;//peak value of sinusoidal current in A
8 //CALCULATIONS
9 function y1=f1(x),y1=(I+Im*sin(x))^2, endfunction
10 a1=(intg(0,2*%pi,f1));
11 a1=a1/(2*%pi);//mean square value in A
12 rms=sqrt(a1);//rms value in A
13 mprintf("rms value is %2.2f A",rms);
14 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 4.8 RELATIVE HEATING EFFECTS

```
1 //Chapter-4, Example 4.8, Page 136
2 //


---


3 clc
4 clear
5 //let the current peak value of sinusoidal and
   rectangular waves are Im.
6 //CALCULATIONS
7 Im=1;//let im current value be 1(just for
   calculation purposes)
8 rms1=sqrt((Im)^2*%pi)/(%pi);//rms current value of
   rectangular wave
9 function y1=f1(x),y1=(Im^2)*(sin(x))^2,endfunction
10 a1=(intg(0,%pi,f1));
11 a1=a1/(%pi);//mean square value in A
12 rms=sqrt(a1);//rms value in A
13 z=((rms)^2/(rms1)^2);//relative heating effects
14 mprintf("relative heating effects is %1.1f",z);
15 //=====END OF PROGRAM


---


```

### Scilab code Exa 4.9 RMS CURRENT

```
1 //Chapter-4, Example 4.9, Page 137
2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 //for subdivision a
7 funcprot(0);
```

```

8 Max=40;
9 rms=max/sqrt(2);
10 mprintf("max and rms values are %d units and %2.2f
    units respectively\n",Max,rms);
11 //for subdivision b
12 //max=A+B
13 //rms=(A+B)/sqrt(2)
14 //for subdivision c
15 max1=sqrt(((10)^2)+((17.3)^2));
16 rms1=Max1/sqrt(2);
17 mprintf("max and rms values are %2.2f units and %2.2
    f units respectively",max1,rms1);
18 //note:in textbook for sub div (c) square root has
    not taken for maximum value computed
19 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.10 TIME

```

1 //Chapter -4, Example 4.10, Page 137
2 //
    =====
3 clc
4 clear
5 //INPUT DATA
6 f=50;//freq in c/s
7 I=20;//current in A
8 Im=I/sqrt(2);
9 t=0.0025;//time in sec
10 //equation for instantaneous emf
11 i=(20*sqrt(2))*sin(2*%pi*f*t);
12 t1=0.0125;
13 i1=(20*sqrt(2))*sin(2*%pi*f*t1);
14 i2=14.14;

```

```

15 x=(i2)/(20*(sqrt(2)));
16 y=asin(x);
17 z=(2*%pi*50);
18 t=y/z;
19 mprintf("current when t is 00025 sec and 0.0125 sec
        are %d A and %d A respectively\n",i,i1);
20 mprintf("time when value of instantaneous cureent
        14.14 is %g sec",t);
21 //note:in textbook for sub div (c) square root has
        not taken for maximum value computed
22 //=====END OF PROGRAM
        =====

```

---

#### Scilab code Exa 4.11 RMS CURRENT

```

1 //Chapter -4, Example 4.11, Page 137
2 //
        =====
3 clc
4 clear
5 //INPUT DATA
6 I1=5;//current in A
7 I=10;//current in A
8 I2=I/sqrt(2);
9 //CALCULATIONS
10 i3=sqrt(((2*I1)^2)+(I2^2));
11 mprintf("rms value of current is %1.2f A
        respectively\n",i3);
12 //=====END OF PROGRAM
        =====

```

---

#### Scilab code Exa 4.12 CURRENT



```

1 //Chapter -4, Example 4.12, Page 138
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 Im=141.4; //instantaneous current
7 f=50; //freq in hz
8 w=2*%pi*f; //angular freq in rad/sec
9 //instantaneous current equation is  $i=141.4*\sin(w*t)$ 
   ;
10 function f=myfun(t)
11     f=Im*sin(w*t(1));
12 endfunction
13 t=[0.0025];
14 g=numdiff(myfun,t)
15 mprintf("rate of change of current is %d A/sec \n",g
   );
16 function f1=myfun(t1)
17     f1=Im*sin(w*t1(1));
18 endfunction
19 t1=[0.005];
20 g1=numdiff(myfun,t1)
21 mprintf("rate of change of current is %d A/sec \n",
   g1);
22 function f2=myfun(t2)
23     f2=Im*sin(w*t2(1));
24 endfunction
25 t2=[0.01];
26 g2=numdiff(myfun,t2)
27 mprintf("rate of change of current is %d A/sec \n",
   g2);
28 //note:answer given in textbook for section c is
   wrong
29 //=====END OF PROGRAM

```

---

### Scilab code Exa 4.13 CURRENT

```
1 //Chapter -4, Example 4.13, Page 138
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 R=60;//resistance in ohms
7 Rf=50;//resistance in ohms
8 Rr=500;//resistance in ohms
9 V=120;//supply voltage in volts
10 f=50;//freq in hz
11 //CALCULATIONS
12 peak=V*sqrt(2);//peak value of applied voltage
13 peak1=peak/(R+Rf);//peak value of current in forward
    direction
14 peak2=peak/(R+Rr);//peak value of current in reverse
    direction
15 i=((2*peak1)-(2*peak2))/(2*%pi);//current in moving
    coil ammeter over the period 0 to 2*(%pi)
16 i1=(%pi/2)*((peak1)^2+(peak2)^2)/(2*(%pi));//mean
    current over the period 0 to 2*(%pi)
17 rms=sqrt(i1);//rms value in hot wire ammeter
18 mprintf("rms value in hot wire ammeter is %1.3f A\n"
    ,rms);
19 If=(peak1)/(sqrt(2));//rms value in forward
    direction
20 mprintf("rms value in forward direction is %1.2f A\n"
    ",If);
21 Ir=(peak2)/(sqrt(2));//rms value in reverse
    direction
22 mprintf("rms value in reverse direction is %1.2f A\n"
```

```

    ",Ir);
23 av=((R+Rf)*((If)^2)+(R+Rr)*((Ir)^2))/(2);
24 mprintf("average power dissipated is %2.2f W\n",av);
25 pf=((Rf)*((If)^2)+(Rr)*((Ir)^2))/(2);
26 mprintf("power dissipated in rectifier is %2.1f W\n"
    ,pf);
27 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.14 CURRENT

```

1 //Chapter -4, Example 4.14, Page 144
2 //
    =====

3 clc
4 clear
5 //given voltage applied is 100*sin(w*t)
6 //CALCULATIONS
7 R=10;//resistance in ohms
8 //i=(100)*sin(w*t)/10=10*sin(w*t)
9 //instantaneous power=1000*(sin(w*t))^2
10 E=(100)/sqrt(2);//average value of voltage in volts
11 I=(10)/sqrt(2);//average value of current in amps
12 P=E*I;//average power in Watts
13 mprintf("thus average power is %1.0f W",P);
14 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.15 POWER

```

1 //Chapter -4, Example 4.15, Page 144

```

```

2 //


---


3 clc
4 clear
5 //given voltage applied is e=340*sin(314*t)
6 //given current applied is i=42.5*sin(314*t)
7 //CALCULATIONS
8 R=340/42.5;//resistance in ohms
9 E=(340)/sqrt(2);//average value of voltage in volts
10 I=(42.5)/sqrt(2);//average value of current in amps
11 P=E*I;//average power in Watts
12 mprintf("thus average power is %1.0f W",P);
13 //=====END OF PROGRAM


---



```

#### Scilab code Exa 4.16 INSTANTANEOUS CURRENT

```

1 //Chapter-4, Example 4.16, Page 145
2 //


---


3 clc
4 clear
5 //given voltage applied is e=100*sin(314*t)
6 //CALCULATIONS
7 E=100/sqrt(2);
8 w=314;
9 L=0.2;//inductance in henry
10 // indefinitely integrating e and later dividing by
    L we get it as
11 //i=-1.592*cos(314*t);//instantaneous current
12 //instantaneous power=e*i=-79.6*sin(628t)
13 P=0;//average power=0
14 Xl=w*L;//inductance in ohms

```

```

15 I=(E)/(X1); //rms current
16 mprintf("inductive reactance and rms current is %2.1
    f ohms and %1.3f amps respectively",X1,I);
17 //note:We cannot compute symbolic or indefinite
    integration in scilab.In order to verify your
    results use wxmaxima software.
18 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.17 INDUCTIVE REACTANCE

```

1 //Chapter -4, Example 4.17, Page 145
2 //
    =====

3 clc
4 clear
5 //CALCULATIONS
6 L=0.225; //inductance in henry
7 e=120; //voltage in volts
8 f=50; //frequency in c/s
9 X1=(2*%pi*f*L); //inductive reactance in ohms
10 mprintf("Inductive reactance in ohms is %2.2f ohms\n
    ",X1);
11 L=0.2; //inductance in henry
12 Im=2.4; //peak value of current in A
13 //instantaneous voltage equation is e=(sqrt(2)*120*
    sin(314*t))
14 // indefinitely integrating e and later dividing by
    L we get it as
15 //i=-2.4*cos(314t); //instantaneous current in A
16 I=Im/(sqrt(2)); //in A
17 mprintf("Current is %1.3f A\n",I);
18 m=(e*sqrt(2)*Im)/2; //maximum power delivered in
    watts

```

```

19 mprintf("Maximum power delivered to inductor is %3.2
    f watts\n",m);
20 mprintf("average power is zero\n")
21 mprintf("equation for voltage and current are
    169.68*sin(314*t) and -2.4*cos(314*t)
    respectively");
22 //note:We cannot compute symbolic or indefinite
    integration in scilab.In order to verify your
    results use wxmaxima software.
23 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 4.18 INDUCTIVE REACTANCE

```

1 //Chapter -4, Example 4.18, Page 146
2 //
    =====
3 clc
4 clear
5 //CALCULATIONS
6 L=0.01;//inductance in henry
7 //equation of current is 10*cos(1500*t)
8 w=1500;//angular freq in rad/sec
9 X1=(w*L);//inductive reactance in ohms
10 mprintf("inductive reactance is %1.1f ohms\n",X1);
11 function f=myfun(t)
12     f=10*cos(w*t);
13 q=derivative(f);
14 endfunction//derivation yields e=-150*sin(1500*t)
15 mprintf("equation for voltage across is e=-150*sin
    (1500*t)")
16 X2=40;//given new inductance in ohms
17 f2=X2/(2*pi*L);//freq in hz
18 mprintf("thus at freq %d hz inductance will be 40

```

```

    ohms",f2)
19 //note:answer given for inductive reactance is wrong
    .Please check the calculations
20 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 4.19 CAPACITIVE REACTANCE

```

1 //Chapter-4, Example 4.19, Page 146
2 //
    =====

3 clc
4 clear
5 //CALCULATIONS
6 C=135;//capacitance in uF
7 E=150;//voltage in volts
8 f=50;//freq in c/s
9 Xc=1/(2*3.14*f*C*10^-6);//capacitive reactance in
    ohms
10 //equation for current is i=8.99*sin(314*t+(%pi/2))A
11 //instantaneous power is P=E*I*sin(2*w*t)
12 P=0;//average power
13 Im=8.99;//peak value of instantaneous current
    equation
14 I=(Im)/(sqrt(2));//rms current in amps
15 M=E*sqrt(2)*I*sqrt(2);//maximum power delivered in
    Watts
16 mprintf("thus capacitive reactance ,Rms current and
    Maximum power delivered are %2.3f ohms ,%1.2f
    Amps,%1.0f Watts respectively",Xc,I,M);
17 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 4.20 IMPEDANCE

```
1 //Chapter -4, Example 4.20, Page 147
2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 //given voltage eqn is  $v=100+(100*\sqrt{2})*\sin(314*t)$ 
   ) volts
7 W=314;//freq in rad/sec
8 R=5;//resistance in ohms
9 X=12;//reactance in ohms
10 Z=R+((%i)*(X)); //impedance in ohms
11 Idc=100/R;//dc current in A
12 Iac=(100)/(sqrt((R)^2+(X)^2)); //rms value of ac
   component of current
13 Pt=(R*(Idc^2))+R*(Iac^2); //total power in Watts
14 V1=sqrt((100)^2+(100)^2); //supplied voltage in Rms
   in volts
15 I1=sqrt((20)^2+(7.69)^2); //current in Rms in Amps
16 Z1=V1/I1; //circuit impedance in ohms
17 Pf=Pt/(V1*I1); //Power factor
18 mprintf("thus circuit impedance, Power expended and
   Power factors are %1.1f Ohms ,%1.0f W and %1.3f
   respectively",Z1,Pt,Pf);
19 //=====END OF PROGRAM
   =====
```

---

### Scilab code Exa 4.21 CURRENT AND PHASE



```

1 //Chapter -4, Example 4.21, Page 147
2 //

```

---

```

3 clc
4 clear
5 function [polar] = r2p(x,y)//function to convert
    rectangular to polar
6 polar = ones(1,2)
7 polar(1) = sqrt((x^2)+(y^2))
8 polar(2) = atan(y/x)
9 polar(2) =(polar(2)*180)/%pi
10 endfunction
11 function [ rect ] = p2r(r,theta)//function to
    convert polar to rectangular
12 rect = ones(1,2)
13 theta =( theta *%pi) /180
14 rect(1)=r* cos(theta)
15 rect(2)=r* sin(theta)
16 endfunction
17 //CALCULATIONS
18 I1=p2r(300,0);
19 disp(I1);
20 I2=p2r(350,30);
21 disp(I2);
22 I=I1+I2;
23 disp(I);
24 i3=r2p(I(1),I(2))
25 disp(i3);
26 mprintf("Thus resultant current is 627.9 A and it
    leads 300 A by 16 degrees")
27 //note:here direct functions for conversion are not
    available and hence we defined user defined
    functions for polar to rect and rect to polar
    conversions
28 //=====END OF PROGRAM

```

---

---

Scilab code Exa 4.22 POWER

```
1 //Chapter -4, Example 4.22, Page 147
2 //


---


3 clc
4 clear
5 funcprot(0)
6 function [polar] = r2p(x,y)//function to convert
    rectangular to polar
7 polar = ones(1,2)
8 polar(1) = sqrt((x^2)+(y^2))
9 polar(2) = atan(y/x)
10 polar(2) =(polar(2)*180)/%pi
11 endfunction
12 function [ rect ] = p2r(r,theta)//function to
    convert polar to rectangular
13 rect = ones(1,2)
14 theta =( theta *%pi) /180
15 rect (1)=r* cos(theta)
16 rect (2)=r* sin(theta)
17 endfunction
18 //v=230*sin(100*%pi*t)
19 //CALCULATIONS
20 R=100;//resistance in ohms
21 L=319;//inductance in mH
22 Xl=(100*%pi*L*10^-3);//inductive reactance in ohms
23 Z=R+((%i)*(Xl));//impedance in ohms
24 Z=r2p(R,Xl);//impedance in polar form
25 disp(Z);
26 Z1=p2r(Z(1),Z(2));
27 disp(Z1);
28 //i=230/1.414*sin(100*%3.14*t-45)=1.626*sin(100*%3
```

```

        .14*t-45)
29 i=(1.626/(sqrt(2))); //rms current in A
30 P=(i)^2*R; //power taken by the coil in W
31 mprintf("power taken by the coil is %3.1f W",P);
32 //note:here direct functions for conversion are not
    available and hence we defined user defined
    functions for polar to rect and rect to polar
    conversions
33 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 4.23 RMS CURRENT

```

1 //Chapter -4, Example 4.23, Page 148
2 //
=====

3 clc
4 clear
5 function [polar] = r2p(x,y) //function to convert
    rectangular to polar
6 polar = ones(1,2)
7 polar(1) = sqrt((x^2)+(y^2))
8 polar(2) = atan(y/x)
9 polar(2) =(polar(2)*180)/%pi
10 endfunction
11 function [rect] = p2r(r,theta) //function to
    convert polar to rectangular
12 rect = ones(1,2)
13 theta =(theta *%pi) /180
14 rect(1)=r* cos(theta)
15 rect(2)=r* sin(theta)
16 endfunction
17 //e1=230*sin(w*t)

```

```

18 //e2=230*sin(w*t*%pi/6)
19 //CALCULATIONS
20 E1=p2r(230,0); //impedance in rectangular form
21 disp(E1);
22 E2=p2r(230,30);
23 disp(E2);
24 E=E1+E2;
25 E=E/sqrt(2);
26 E=r2p(E(1),E(2));
27 disp(E)
28 Z=r2p(8,6);
29 disp(Z);
30 I1=E(1)/Z(1);
31 disp(I1)
32 theta=E(2)-Z(2);
33 disp(theta);
34 phi=cos(theta*%pi/180)
35 disp(phi)
36 P1=(E(1))*(I1)*(phi); //power supplied in Watts
37 mprintf("Thus Rms current and power supplied are %2
        .1f A and %f W respectively",I1,P1);
38 //note here power calculated may vary as we took many
        decimal values for calculation.Please check the
        calculations
39 //note:here direct functions for conversion are not
        available and hence we defined user defined
        functions for polar to rect and rect to polar
        conversions
40 //=====END OF PROGRAM

```

---

#### Scilab code Exa 4.24 CURRENT

1 //Chapter –4, Example 4.24, Page 148

```

2 //
=====

3 clc
4 clear
5 //CALCULATIONS
6 //e1=230*sin(100*pi*t)
7 C=20*10^-6; //capacitance in F
8 //e2=230*sin(700*pi*t)
9 Vm1=230; //peak voltage for e1
10 Vm2=35; //peak voltage for e2
11 I1=Vm1*(100*pi*C)/(sqrt(2)); //current due to
    component e1
12 I2=Vm2*(700*pi*C)/(sqrt(2)); //current due to
    component e2
13 mprintf("thus current due to component e1 and e2 are
    %1.2fA and %1.2fA respectively",I1,I2);
14 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 4.25 RMS CURRENT

```

1 //Chapter-4, Example 4.25, Page 149
2 //
=====

3 clc
4 clear
5 funcprot(0)
6 function [polar] = r2p(x,y) //function to convert
    rectangular to polar
7 polar = ones(1,2)
8 polar(1) = sqrt((x^2)+(y^2))
9 polar(2) = atan(y/x)

```

```

10 polar(2) =(polar (2)*180)/%pi
11 endfunction
12 function [ rect ] = p2r(r,theta)//function to
    convert polar to rectangular
13 rect = ones(1 ,2)
14 theta =( theta *%pi) /180
15 rect (1)=r* cos(theta)
16 rect (2)=r* sin(theta)
17 endfunction
18 //CALCULATIONS
19 //v=230*sin(314*t)+60*sin(942*t)
20 V=230;//voltage in volts
21 V1=60;//voltage of harmonic in volts
22 R=10;//resistance in ohms
23 L=0.3;//inductance in henry
24 C=100*10^-6;//capacitance in F
25 //Branch with Resistor (R)
26 I1m=V/R;//current in A
27 I1m=I1m/(sqrt(2));//rms current in A
28 I3m=V1/R;//current in A
29 I3m=I3m/(sqrt(2));//rms current in A
30 I=sqrt((I1m)^2+(I3m)^2);//rms current in A
31 Pr=((I)^2)*(R);//power in Watts
32 //Branch with inductor(L)
33 Z1=(10+((%i)*(314*0.03)));//impedance to fundamental
    component
34 M=sqrt((10)^2+(9.42)^2);//magnitude of Z1 in polar
    form
35 theta=atan(9.42/10)*(180/%pi);//angle of Z1 in polar
    form
36 I2m=V/M;//fundamental current in A
37 I2m=I2m/(sqrt(2));//rms current in A
38 I4m=V1/M;//third harmonic component of current
39 I4m=I4m/(sqrt(2));//rms current in A
40 I1=((I2m)^2+(I4m)^2);//total rms current in A
41 Pr1=(I1)*(R);//Power in Watts
42 //branch with capacitor
43 X1=1/(314*10^-4);//reactance to fundamental

```

```

        component in ohms
44 I5m=V/(X1); //current in A
45 I5m=I5m/(sqrt(2)); //rms current in A
46 X2=1/(942*10^-4); //reactance to third harmonic
        component in ohms
47 I6m=V1/X2; //current in A
48 I6m=I6m/(sqrt(2)); //rms current in A
49 I2=sqrt((I5m)^2+(I6m)^2); //total rms current in A
50 Pr2=0; //power in watts
51 T=Pr+Pr1+Pr2; //total power dissipated in W
52 //calculation of total current
53 Im=(p2r(16.26,0)+p2r(11.84,43.29)+p2r(5.1,90)); //pol
        to rect
54 disp(Im); //fundamental component of current in A
55 Im1=(p2r(4.24,0)+p2r(3.09,-43.29)+p2r(4,90)); //pol
        to rect
56 disp(Im1); //third harmonic component of current in A
57 T1=sqrt((Im(1))^2+(Im1(1))^2); //total rms current in
        A
58 V2=(sqrt((V)^2+(V1)^2))/sqrt(2); //voltage applied in
        rms
59 pf=T/((T1)*(V2)); //power factor
60 mprintf("thus total current ,power input and power
        factor are %2.2f A ,%f W,%1.2f respectively",T1,T
        ,pf);
61 //=====END OF PROGRAM

```

---

# Chapter 5

## SINGLE PHASE AC CIRCUITS

Scilab code Exa 5.1 POLAR

```
1 //Chapter -5, Example 5.1, Page 157
2 //


---


3 clc
4 clear
5 function [polar] = r2p(x,y)//function to convert
   rectangular to polar
6 polar = ones(1,2)
7 polar(1) = sqrt ((x ^2) +(y^2))
8 polar(2) = atan (y/x)
9 polar(2) =(polar (2)*180)/%pi
10 endfunction
11 function [ rect ] = p2r(r,theta)//function to
   convert polar to rectangular
12 rect = ones(1 ,2)
13 theta =( theta *%pi) /180
14 rect (1)=r* cos(theta)
15 rect (2)=r* sin(theta)
```



```

16  endfunction
17  //CALCULATIONS
18  I1=r2p(7,-5);
19  disp(I1);
20  I2=r2p(-9,6);
21  I2(2)=I2(2)+(180);//this belongs to quadrant 2 and
    hence 180 degrees should be added
22  disp(I2);
23  I3=r2p(-8,-8);
24  I3(2)=I3(2)+(180);//this belongs to quadrant 3 and
    hence 180 degrees should be added
25  disp(I3);
26  I4=r2p(6,6);
27  disp(I4);
28  //note:here direct functions for conversion are not
    available and hence we defined user defined
    functions for polar to rect and rect to polar
    conversions
29  //=====END OF PROGRAM

```

---

### Scilab code Exa 5.2 POLAR

```

1  //Chapter -5, Example 5.2, Page 157
2  //

```

---

```

3  clc
4  clear
5  function [polar] = r2p(x,y)//function to convert
    rectangular to polar
6  polar = ones(1,2)
7  polar(1) = sqrt((x^2)+(y^2))
8  polar(2) = atan(y/x)

```

```

9  polar(2) =(polar (2)*180)/%pi
10 endfunction
11 function [ rect ] = p2r(r,theta)//function to
    convert polar to rectangular
12 rect = ones(1,2)
13 theta =( theta *%pi) /180
14 rect (1)=r* cos(theta)
15 rect (2)=r* sin(theta)
16 endfunction
17 //CALCULATIONS
18 //for subdivision 1
19 I1=p2r(10,60);
20 I2=p2r(8,-45);
21 I3=I1+I2;
22 disp(I3);
23 I4=r2p(I3(1),I3(2));
24 disp(I4)
25 //for subdivision 2
26 I5=r2p(5,4);
27 I6=r2p(-4,-6);
28 I7(1)=(I5(1))*(I6(1));
29 I7(2)=(I5(2)+I6(2));
30 I7(2)=I7(2)-180;
31 disp(I7);
32 //for subdivision 3
33 I8=r2p(-2,-5);
34 I9=r2p(5,7);
35 I10(1)=I8(1)/I9(1);
36 I10(2)=I8(2)-I9(2);
37 I10(2)=I10(2)-180
38 disp(I10);
39 //note:here direct functions for conversion are not
    available and hence we defined user defined
    functions for polar to rect and rect to polar
    conversions
40 //=====END OF PROGRAM

```

---

---

### Scilab code Exa 5.3 IMPEDANCE

```
1 //Chapter -5, Example 5.3, Page 160
2 //


---


3 clc
4 clear
5 //given  $i(t)=5\sin(314*t+(2*\%pi/3))$  &&  $v(t)=20\sin$ 
   ( $314*t+(5*\%pi/6)$ )
6 //CALCULATIONS
7 P1=2*(%pi/3); //phase angle of current in radians
8 P1=P1*(180/%pi); //phase angle of current in degrees
9 P2=5*(%pi/6); //phase angle of voltage in radians
10 P2=P2*(180/%pi); //phase angle of voltage in degrees
11 P3=P2-P1; //current lags voltage by P3 degrees
12 P4=P3*%pi/180;
13 pf=cos(P4); //lagging pf
14 Vm=20; //peak voltage
15 Im=5; //peak current
16 Z=Vm/Im; //impedance in ohms
17 R=(Z)*cos(P4); //resistance in ohms
18 Xl=sqrt((Z)^2-(R)^2); //reactance
19 W=314;
20 L=Xl/W; //inductance in henry
21 V=Vm/sqrt(2); //average value of voltage
22 I=Im/sqrt(2); //average value of current
23 av=(V*I)*cos(P4); //average power in watts
24 mprintf("thus impedance, resistance, inductance,
   powerfactor and average power are %d ohms, %1.2 f
   ohms, %g H, %1.3 f and %2.1 f W respectively", Z, R, L,
   pf, av);
25 //=====END OF PROGRAM
```

---

---

### Scilab code Exa 5.4 IMPEDANCE

```
1 //Chapter -5, Example 5.4, Page 161
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 I=10; //given current in A
7 P=1000; //power in Watts
8 V=250; //voltage in volts
9 f=25; //frequency in Hz
10 //CALCULATIONS
11 R=P/((I)^2); //resistance in ohms
12 Z=V/I; //impedance in ohms
13 Xl=sqrt((Z)^2-(R)^2); //reactance in ohms
14 L=Xl/(2*%pi*f); //inductance in Henry
15 Pf=R/Z; //power factor ,lagging ,pf=cos(phi)
16 mprintf("thus impedance ,resistance ,inductance ,
    reactance and powerfactor are %d ohms,%d ohms,%1
    .3f H,%2.2f ohms and %1.1f respectively",Z,R,L,Xl
    ,Pf);
17 //=====END OF PROGRAM


---


```

### Scilab code Exa 5.5 IMPEDANCE

```
1 //Chapter -5, Example 5.5, Page 162
```

```

2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V=250; //supply voltage in volts
7 f=50; //frequency in hz
8 Vr=125; //voltage across resistance in volts
9 Vc=200; //voltage across coil in volts
10 I=5; //current in A
11 //CALCULATIONS
12 R=Vr/I; //resistance in ohms
13 Z1=Vc/I; //impedance of coil in ohms
14 //Z1=sqrt((R1)^2+(X1)^2)-----eqn(1)
15 Z=V/I; //total impedance in ohms
16 //Z=sqrt((R+R1)^2+(X1)^2)-----eqn(2)
17 //solving eqn(1)and eqn(2) we get R1 as follows
18 R1=((Z)^2-(Z1)^2)-(R)^2)/(2*R); //in ohms
19 X1=sqrt((Z1)^2-(R1)^2); //reactance of coil in ohms
20 P=((I)^2*R1); //power absorbed by the coil in Watts
21 Pt=((I)^2)*(R+R1); //total power in Watts
22 mprintf("thus impedance, resistance, reactance are %d
    ohms, %d ohms, %2.2f ohms respectively\n", Z1, R, X1);
23 mprintf("power absorbed and total power are %3.1f W
    and %3.1f W respectively", P, Pt)
24
25 //=====END OF PROGRAM


---



```

### Scilab code Exa 5.6 RESISTANCE

```

1 //Chapter -5, Example 5.6, Page 163
2 //

```

---

```

3  clc
4  clear
5  //INPUT DATA
6  V=240; //supply voltage in volts
7  V1=171; //voltage across inductor in volts
8  I=3; //current in A
9  phi=37; //power factor lagging in degrees
10 //CALCULATIONS
11 Z1=V1/I; //impedance of coil in ohms
12 //Z1=sqrt((R1)^2+(X1)^2)—————eqn(1)
13 Z=V/I; //total impedance in ohms
14 //Z=sqrt((R+R1)^2+(X1)^2)—————eqn(2)
15 pf=cos(phi*%pi/180); //powerfactor
16 Rt=pf*Z; //total resistance in ohms//Rt=(R+R1)
17 //substituting Rt value in eqn(2) we find X1 as
   follows
18 X1=sqrt((Z)^2-(Rt)^2); //reactance of inductor in
   ohms
19 //ubstituting X1 value in eqn(1) we find R1 as
   follows
20 R1=sqrt((Z1)^2-(X1)^2); //resistance of inductor in
   ohms
21 R=Rt-R1; //resistance of resistor in ohms
22 mprintf("Thus resistance of resistor is %2.2f ohms\
   n",R);
23 mprintf("Thus resisitance and reactance of inductor
   are %2.2f ohms and %2.2f ohms respectively",R1,X1
   )
24
25 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.7 CURRENT

```
1 //Chapter-5, Example 5.7, Page 164
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V=100; //supply voltage in volts
7 //for COIL A
8 f=50; //frequency in Hz
9 I1=8; //current in A
10 P1=120; //power in Watts
11 //for COIL B
12 I2=10; //current in A
13 P2=500; //power in Watts
14 //CALCULATIONS
15 //FOR COIL A
16 Z1=V/I1; //impedance of coil A in ohms
17 R1=P1/(I1)^2; //resistance of coil A in ohms
18 X1=sqrt((Z1)^2-(R1)^2); //reactance of coil A in
    ohms
19 //FOR COIL B
20 Z2=V/I2; //impedance of coil B in ohms
21 R2=P2/(I2)^2; //resistance of coil B in ohms
22 X2=sqrt((Z2)^2-(R2)^2); //reactance of coil B in
    ohms
23 //When both COILS A and B are in series
24 Rt=R1+R2; //total resistance in ohms
25 Xt=X1+X2; //total reactance in ohms
26 Zt=sqrt((Rt)^2+(Xt)^2); //total impedance in ohms
27 It=V/Zt; //current drawn in A
28 P=((It)^2)*(Rt); //power taken in watts
29 mprintf("Thus current drawn and power taken in watts
    are %2.2f A and %3.2f W respectively",It,P);
30 //=====END OF PROGRAM


---


```

---

### Scilab code Exa 5.8 IMPEDANCE

```
1 //Chapter -5, Example 5.8, Page 167
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 R=100;//resistance in ohms
7 C=50*10^-6;//capacitance in F
8 V=200;//voltage in Volts
9 f=50;//frequency in Hz
10 //Z=R-(%i)*(Xc)----->impedance
11 Xc=1/(2*%pi*f*C);//capacitive reactance in ohms
12 Z=sqrt((R)^2+(Xc)^2);//impedance in ohms
13 I=V/Z;//current in A
14 pf=R/Z;//power factor ----->cos(phi)---->leading
15 phi=acos(0.844);//phase angle in radians
16 phi=phi*180/%pi;//phase angle in degrees
17 Vr=(I)*(R);//voltage across resistor
18 Vc=(I)*(Xc);//voltage across capacitor
19 mprintf("Thus impedance, current, powerfactor and
    phaseangle are %3.2f ohms,%1.2f A,%1.3f and %2.2f
    degrees respectively\n",Z,I,pf,phi);
20 mprintf("voltage across resistor and capacitor are
    %d V and %3.2f V respectively",Vr,Vc)
21
22 //=====END OF PROGRAM


---


23
24 ;
```



---

**Scilab code Exa 5.9 POWER FACTOR**

```
1 //Chapter –5, Example 5.9, Page 169
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 phi=40;//phase in degrees
7 V=150;//voltage in Volts
8 I=8;//current in A
9 //the applied voltage lags behind the current .That
   means the current leads the voltage
10 //hence pf is leading
11 //CALCULATIONS
12 pf=cos(phi*%pi/180);//in degrees —>leading
13 //hence it is a capacitive circuit
14 pa=V*I*pf;//active power in W
15 pr=V*I*sin(phi*%pi/180);//reactive power in VAR
16 mprintf("Thus active and reactive power are %3.1f W
   and %3.1f VAR respectively",pa,pr);
17 //=====END OF PROGRAM


---


18
19 ;
```

---

**Scilab code Exa 5.10 IMPEDANCE**

```
1 //Chapter –5, Example 5.10, Page 169
```

```

2 //


---


3 clc
4 clear
5 //INPUT DATA
6 //given  $v=141.4*\sin(314*t)$ 
7  $P=700$ ; //power in Watts
8  $pf=0.707$ ; //powerfactor  $\longrightarrow$  leading  $\longrightarrow$   $\cos(\phi)$ 
9  $V_m=141.4$ ; //maximum value of supply voltage
10 //CALCULATIONS
11  $V_r=V_m/(\text{sqrt}(2))$ ; //rms value of supply voltage
12  $I=P/(V_r*pf)$ ; //current in A
13  $Z=V_r/I$ ; //impedance in ohms
14  $R=(Z)*(pf)$ ; //resistance in ohms
15  $\phi=\text{acos}(pf*180/\%pi)$ ; //angle in degrees
16  $X_c=(Z)*(\text{sin}(\phi))$ ; //reactance in ohms
17  $C=1/(3.14*7.13)$ ; //Capacitance in F
18 mprintf("Thus resistance and capacitance are %1.2f
           ohms and %g F respectively",R,C);
19 //=====END OF PROGRAM


---


20
21 ;


---



```

### Scilab code Exa 5.11 RESISTANCE

```

1 //Chapter -5, Example 5.11, Page 169
2 //


---


3 clc
4 clear
5 //INPUT DATA

```

```

6 V=200; //supply voltage in volts
7 f=50; //freq in hz
8 P=7000; //power in Watts
9 Vr=130; //volatge across resistor in volts
10 P=7000; //power in Watts
11 //CALCULATIONS
12 R=((Vr)^2)/P; //resistance in ohms
13 I=Vr/R; //current in A
14 Z=V/I; //total impedance in ohms
15 Xc=sqrt((Z)^2-(R)^2);
16 C=1/(2*%pi*f*Xc); //Capacitance in F
17 pf=R/Z; //power factor ----->leading
18 phi=acos(pf); //angle in radians
19 phi=phi*180/%pi; //angle in degrees
20 Vm=V*sqrt(2); //maximum value of voltage
21 //voltage equation v=Vm*sin(2*%pi*f*t)----->282.84*
    sin(314.16*t)
22 //current leads voltage by phi
23 //current equation ----->i=76.155*sin(314.16*t+phi)
24 mprintf("Thus current ,resistance ,p.f ,capacitance ,
    impedance are %2.2f A ,%1.2f ohms,%2.1f ,%g F and
    %1.2f ohms respectively",I,R,pf,C,Z);
25 //=====END OF PROGRAM
    =====
26
27 ;

```

---

### Scilab code Exa 5.12 IMPEDANCE

```

1 //Chapter -5, Example 5.12, Page 170
2 //
    =====
3 clc

```

```

4 clear
5 //INPUT DATA
6 C=50; //capacitance in uf
7 R=100; //resistance in ohms
8 V=200; //supply voltage in volts
9 f=50; //freq in hz
10 //CALCULATIONS
11 Xc=1/(2*%pi*f*C*10^-6); //capacitive reactance in
    ohms
12 Z=R-((%i)*Xc); //impedance in ohms
13 disp(Z);
14 z1=sqrt((R)^2+(Xc)^2);
15 theta=atan(Xc/R);
16 pf=cos(theta); //powerfactor
17 I=V/z1; //current in A
18 P=V*I*pf; //power in Watts
19 mprintf("Thus current ,power factor ,power are % 1.2 f
    A ,%1.3 f ,%d W respectively",I,pf,P);
20 //=====END OF PROGRAM

```

---

```

21
22 ;

```

---

### Scilab code Exa 5.13 INDUCTANCE

```

1 //Chapter -5, Example 5.13, Page 170
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 C=0.05; //capacitance in uf
7 F=500; //freq in hz

```

```

8 //CALCULATIONS
9 Xl=1/(2*%pi*F*C*10^-6); //capacitive reactance in
    ohms
10 //at resonance Xl=Xc
11 L=(Xl/(2*%pi*F)); //inductance in H
12 mprintf("Thus value of L is %1.2f H",L);
13 //=====END OF PROGRAM

```

---

```

14
15 ;

```

---

#### Scilab code Exa 5.14 CURRENT

```

1 //Chapter -5, Example 5.14, Page 171
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V=200; //voltage in V
7 R=50; //resistance in ohms
8 L=0.5; //inductance in Henry
9 F=50; //freq in hz
10 //CALCULATIONS
11 Xl=2*%pi*F*L; //inductive reactance
12 Z=(R)+((%i)*Xl) //impedance
13 disp(Z);
14 z1=sqrt((R)^2+(Xl)^2); //magnitude
15 theta=atan(Xl/R); //angle in radians
16 I=V/z1; //current in A
17 P=V*I*cos(theta); //power supplied in W
18 //here capacitive reactance equals inductive
    reactance

```

```

19 //hence  $X_c=X_l$ 
20  $C=1/(2*\%pi*f*X_l)$ ; //capacitance in uf
21  $r=(V/I)-(R)$ ; //additional resistance to be added in
    series
22 mprintf("Thus current and power required are % 1.2 f
    A and %2.2 f W respectively\n",I,P);
23 mprintf("Thus additional resistance that needs to be
    connected in series with R and C to have same
    current at unity power factor is %1.1 f ohms",r);
24 //=====END OF PROGRAM
    =====

25
26 ;

```

---

### Scilab code Exa 5.15 CAPACITANCE

```

1 //Chapter -5, Example 5.15, Page 171
2 //
    =====

3 clc
4 clear
5 //INPUT DATA
6  $R=50$ ; //resistance in ohms
7  $L=9$ ; //inductance in Henry
8  $I_0=1$ ; //current in A
9  $f=75$ ; //frequency in Hz
10 //at resonance  $X_l=X_c$ 
11 //CALCULATIONS
12  $X_l=2*\%pi*f*L$ ; //inductive reactance
13  $X_c=X_l$ ; //capacitive reactance
14  $C=1/(2*\%pi*f*X_c)$ ; //capacitance in uf
15 mprintf("Thus capacitance is %g F",C);
16 //=====END OF PROGRAM
    =====

```

---

---

17  
18 ;

---

### Scilab code Exa 5.16 INDUCTIVE REACTANCE

```
1 //Chapter -5, Example 5.16, Page 175
2 //
3 clc
4 clear
5 //INPUT DATA
6 R=10; //resistance in ohms
7 L=0.1; //inductance in Henry
8 C=150; //capacitor in uf
9 V=200; //voltage in V
10 f=50; //frequency in hz
11 //CALCULATIONS
12 Xc=1/(2*%pi*f*C*10^-6); //Capacitive reactance in
    ohms
13 Xl=(2*%pi*f*L); //inductive reactance in ohms
14 Z=R+((%i)*(Xl-Xc)); //impedance in ohms
15 z1=sqrt((R)^2+(Xl-Xc)^2); //magnitude of Z
16 I=V/z1; //current in A
17 pf=R/z1; //power factor ——>cos(phi)
18 //As Xl-Xc is inductive, pf is lagging
19 z2=sqrt((R^2)+(Xl)^2); //impedance of coil in ohms
20 V1=I*(z2); //voltage across coil in volts
21 Vc=I*(Xc); //voltage across capacitor in volts
22 mprintf("Thus inductive reactance ,capacitive
    reactance ,impedance ,current ,powerfactor are %2.2 f
    ohms,%2.2 f ohms,%2.2 f ohms,%d A,%1.1 f
    respectively ,",Xl,Xc,z1,I,pf);
```

```
23 //=====END OF PROGRAM
```

```
24
```

```
25 ;
```

---

### Scilab code Exa 5.17 RESISTANCE

```
1 //Chapter -5, Example 5.17, Page 176
2 //
3 clc
4 clear
5 //INPUT DATA
6 L=10;//inductance in milliHenry
7 C=5;//capacitor in uf
8 phi=50;//phase in degrees————>lagging
9 f=500;//frequency in hz
10 V=200;//supply voltage in volts
11 //CALCULATIONS
12 Xc=1/(2*%pi*f*C*10^-6);//Capacitive reactance in
    ohms
13 Xl=(2*%pi*f*L*10^-3);//inductive reactance in ohms
14 R=(Xc-Xl)/(tan(phi*%pi/180));//resistance in ohms
15 Z=sqrt((R)^2+(Xc-Xl)^2);//impedance in ohms
16 I=V/Z;//current in A
17 Vr=(I)*(R);//voltage across resistance
18 Vl=(I)*(Xl);//voltage across inductance
19 Vc=(I)*(Xc);//voltage across capacitance
20 mprintf("Thus voltages across resistance ,inductance ,
    capacitance are %3.2f volts ,%3.2f volts ,%3.2f
    volts respectively ,",Vr,Vl,Vc);
21 //=====END OF PROGRAM
```



22  
23 ;

---

### Scilab code Exa 5.18 CAPACITANCE

```
1 //Chapter -5, Example 5.18, Page 176
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 L=5;//inductance in Henry
7 f=50;//frequency in hz
8 V=230;//supply voltage in volts
9 R=2;//resistance in ohms
10 V1=250;//voltage across coil in V
11 //CALCULATIONS
12 Xl=(2*%pi*f*L);//inductive reactance in ohms
13 Z1=sqrt((R)^2+(Xl)^2);//impedance of coil in ohms
14 I=V1/Z1;//current in A
15 Z=V/I;//total impedance in ohms
16 //Z=sqrt((R)^2+(Xl-Xc)^2) and solving for Xc
17 Xc=poly(0,"Xc");
18 p=(Xc^2)-3141.58*(Xc)+378004
19 roots2 = roots (p);
20 r2 = roots2 (2);
21 //Xc cannot be greater than Z
22 C=1/(2*%pi*f*r2);//capacitance in F
23 mprintf("Thus value of C that must be present such
    that voltage across coil is 250 volts is %g F
    respectively ,",C);
24 //=====END OF PROGRAM=====
```

---

25  
26 ;

---

### Scilab code Exa 5.19 RESISTANCE AND CAPACITANCE

```
1 //Chapter -5, Example 5.19, Page 178
2 //


---


3 clc
4 clear
5 //v=350*cos(3000*t-20)
6 //i=15*cos(3000*t-60)
7 //INPUT DATA
8 L=0.5;//inductance in Henry
9 phi=-40;//phase difference between applied voltage
   and current
10 //Xl>Xc(P.f is lagging)
11 w=3000;//freq in hz
12 Vm=350;//peak voltage in volts
13 Im=15;//peak current in amps
14 //CALCULATIONS
15 Z=Vm/Im;//total impedance in ohms
16 //Xl-Xc=0.839*R=X
17 //Z=sqrt((R)^2+(X)^2)
18 //Z=1.305*R
19 R=Z/1.305;//resistance in ohms
20 X=0.839*R;//
21 //X=Xl-Xc
22 Xl=w*L;//reactive inductance in ohms
23 Xc=Xl-X;//capacitive reactance in ohms
24 C=1/(w*Xc);//capacitance in uf
25 mprintf("Thus resistance and capacitance are %2.2f
   ohms and %g F respectively ,",R,C);
```

```
26 //=====END OF PROGRAM
```

---

### Scilab code Exa 5.20 ADMITTANCE

```
1 //Chapter -5, Example 5.20, Page 182
2 //
3 clc
4 clear
5 //INPUT DATA
6 R=10; //resistance in ohms
7 L=0.1; //inductance in henry
8 f=50; //frequency in hz
9 //CALCULATIONS
10 Xl=(2*%pi*f*L); //inductive reactance in ohms
11 Z=R+((%i)*(Xl)); //impedance in ohms
12 Y=inv(Z); //admittance in mho
13 disp(Y);
14 y=abs(Y); //admittance in mho
15 mprintf("admittance is %1.5f mho",y);
16 //=====END OF PROGRAM
```

---

### Scilab code Exa 5.21 ADMITTANCE

```
1 //Chapter -5, Example 5.21, Page 182
2 //
```

---

```

3  clc
4  clear
5  //INPUT DATA
6  //CALCULATIONS
7  Z=10+((%i)*(5)); //impedance in ohms
8  Y=inv(Z); //Admittance in mho
9  disp(Y);
10 //=====END OF PROGRAM

```

---

#### Scilab code Exa 5.22 ADMITTANCE

```

1  //Chapter -5, Example 5.22, Page 182
2  //

```

---

```

3  clc
4  clear
5  //INPUT DATA
6  Z1=7+((%i)*5); //impedance of branch1 in ohms
7  Z2=10-((%i)*8); //impedance of branch2 in ohms
8  V=230; //supply voltage in volts
9  f=50; //frequency in hz
10 //CALCULATIONS
11 Y1=1/(Z1); //admittance of branch1 in mho
12 Y2=1/(Z2); //admittance of branch2 in mho
13 Y=Y1+Y2; //admittance of combined circuit
14 disp(Y);
15 g=abs(Y); //conductance in mho;
16 B=atan(imag(Y)/real(Y)); //susceptance in mho
17 I=V*(Y); //current
18 disp(I); //total current taken from mains in A
19 z=atan(imag(I)/real(I));
20 pf=cos(z); //power factor

```

```

21 mprintf("thus conductance and susceptance of the
    circuit is %1.3f mho and %1.3f mho respectively\n
    ",g,B);
22 mprintf("power factor is %1.3f lagging",pf)
23 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.23 FREQUENCY

```

1 //Chapter -5, Example 5.23, Page 183
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V=240;//voltage in volts
7 f=50;//frequency in Hz
8 R=15;//resistance in ohms
9 I=22.1;//current in A
10 //CALCULATIONS
11 G=1/R;//conductance in mho
12 //susceptance of the circuit ,B=1/(Xl)=0.00318/L
13 //admittance of the circuit ,(G-jB)=(0.067-j(0.00318/
    L))
14 Y=I/V;//admittance in mho;
15 //Y=sqrt((0.067)^2+(0.00318/L)^2)=0.092-----eqn(1)
16 //solving eqn(1) for L we have it as
17 L=sqrt((0.00318)^2/((Y)^2-(G)^2));//inductance in
    henry
18 //when current is 34A
19 I1=34;//current in A
20 Y1=I1/V;//admittance in mho
21 //for Y1 we need to find f

```

```

22 f1=sqrt((3.183)^2/((Y1)^2-(G)^2)); //frequency in hz
23 mprintf("Thus value of frequency when current is 34A
    is %2.1f Hz",f1);
24 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.24 CURRENT

```

1 //Chapter -5, Example 5.24, Page 184
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 L=0.05; //inductance in henry
7 R2=20; //resistance in ohms
8 R1=15; //resistance in ohms
9 V=200; //supply voltage in volts
10 f=50; //frequency in hz
11 //CALCULATIONS
12 //for branch 1
13 Z1=(R1)+((%i)*(2*%pi*f*L)); //impedance in ohms
14 Y1=inv(Z1); //admittance in branch
15 I1=V*(Y1); //current in branch
16 disp(I1);
17 i1=abs(I1); //magnitude of current
18 //for branch 2
19 Y2=1/R2; //admittance in branch
20 I2=V*Y2; //current in branch
21 i2=abs(I2); //magnitude of current
22 I=I1+I2; //total current in A
23 i=abs(I); //magnitude of total current
24 theta=atan(imag(I)/real(I)); //angle in radians

```

```

25 theta=theta*(180)/(%pi); //angle in degrees
26 mprintf("Thus current in branch1,branch2 abd total
    currents are %1.2f A,%d A,%2.2f A respectively\n"
    ,i1,i2,i);
27 mprintf("phase angle of the combination is %2.1f
    degrees",theta);
28 //=====END OF PROGRAM

```

---

#### Scilab code Exa 5.25 TOTAL CURRENT

```

1 //Chapter -5, Example 5.25, Page 185
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 L=6; //inductance in millihenry
7 R2=50; //resistance in ohms
8 R1=40; //resistance in ohms
9 C=4; //capacitance in uf
10 V=100; //voltage in volts
11 f=800; //frequency in hz
12 //CALCULATIONS
13 Xl=(2*%pi*f*L*10^-3); //inductive reactance in ohms
14 Xc=1/(2*%pi*f*C*10^-6); //capacitive reactance in
    ohms
15 Y1=inv((R1)+(%i*Xl)); //admittance of branch1 in mho
16 Y2=inv((R2)-(%i*Xc)); //admittance of branch2 in mho
17 I1=V*(Y1); //current in branch 1
18 I2=V*(Y2); //current in branch 2
19 I=I1+I2; //total current in A
20 theta=(atan(imag(I1)/real(I1))-atan(imag(I2)/real(I2)

```

```

    ));
21 theta=theta*180/%pi; //angle in degrees
22 mprintf("Thus total current taken from supply is %2
    .2f\n",abs(I));
23 mprintf("phase angle between currents of coil and
    capacitor is %2.2f degrees",theta);
24 //=====END OF PROGRAM
=====

```

---

### Scilab code Exa 5.26 POWER

```

1 //Chapter –5, Example 5.26, Page 186
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Z1=10+(%i*15); //impedance in ohms
7 Z2=6-(%i*8); //impedance in ohms
8 I=15; //current in A
9 //CALCULATIONS
10 I1=((Z2)/(Z1+Z2))*(I); //using current division rule
11 I2=((Z1)/(Z1+Z2))*(I); //using current division rule
12 i1=abs(I1); //magnitude of current 1
13 i2=abs(I2); //magnitude of current 2
14 P1=((i1)^2)*(Z1(1)); //power consumed by branch 1
15 P2=((i2)^2)*(Z2(1)); //power consumed by branch 2
16 mprintf("Thus power consumed by branches 1 and 2 are
    %3.2f W and %4.1f W respectively",P1,P2);
17 //=====END OF PROGRAM
=====

```

---



### Scilab code Exa 5.27 CURRENT

```
1 //Chapter –5, Example 5.27, Page 187
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V=200;//voltage in volts
7 f=50;//frequency in hz
8 R1=10;//resistance in ohms
9 L1=0.0023;//inductance in henry
10 R2=5;//resistance in ohms
11 L2=0.035;//inductance in henry
12 //CALCULATIONS
13 Xl1=(2*%pi*f*L1);//inductive reactance in branch 1
    in ohm
14 Xl2=(2*%pi*f*L2);//inductive reactance in branch 2
    in ohm
15 Y1=inv(10+(%i*7.23));//admittance of branch 1 in mho
16 Y2=inv(5+(%i*10.99));//admittance of branch 2 in mho
17 Y=Y1+Y2;//total admittance in mho
18 I1=V*(Y1);//current through branch1
19 I2=V*(Y2);//current through branch2
20 I=I1+I2;//total current in A
21 theta=atan(imag(I)/real(I));//angle in radians
22 pf_of_combination=cos(theta);//powerfactor ——>
    lagging
23 mprintf("Thus currents in branch1,branch2 and total
    current are %2.1f A,%2.1f A and %2.2f A
    respectively\n",abs(I1),abs(I2),abs(I));
24 mprintf("pf of combination is %1.3f",
    pf_of_combination);
```

```
25 //=====END OF PROGRAM
```

---

### Scilab code Exa 5.28 CURRENT

```
1 //Chapter -5, Example 5.28, Page 189
2 //
3 clc
4 clear
5 //INPUT DATA
6 f=50; //freq in hz
7 V=100; //volatge in V
8 L1=0.015; //inductance in branch 1 in henry
9 L2=0.08; //inductance in branch 2 in henry
10 R1=2; //resistance of branch 1 in ohms
11 x1=4.71; //reactance of branch 1 in ohms
12 R2=1; //resistance of branch 2 in ohms
13 x2=25.13; //reactance of branch 2 in ohms
14 Z1=(R1)+(i*x1); //impedance of branch1 in ohms
15 Z2=(R2)+(i*x2); //impedance of branch1 in ohms
16 I1=V/Z1; //current in branch 1 in A
17 printf("current in branch 1 in A")
18 disp(I1);
19 I2=V/Z2; //current in branch 2 in A
20 printf("current in branch 2 in A")
21 disp(I2);
22 I3=I1+I2; //total current in A
23 printf("total current in A")
24 disp(I3);
25 //note: Answer for real part of total current given
    in textbook is wrong. Please check the
    calculations
```

```
26 //=====END OF PROGRAM
```

---

### Scilab code Exa 5.29 ADMITTANCE

```
1 //Chapter -5, Example 5.29, Page 189
2 //
3 clc
4 clear
5 //CALCULATIONS
6 R=8;//resistance in ohms
7 Xc=-(%i)*12;//capacitive reactance in ohms
8 Y=(inv(R)+inv(Xc));//admittance in mho
9 disp(Y);
10 //=====END OF PROGRAM
```

---

### Scilab code Exa 5.30 ADMITTANCE

```
1 //Chapter -5, Example 5.30, Page 189
2 //
3 clc
4 clear
5 //CALCULATIONS
6 R=3;//resistance in ohms
7 Xl=(%i)*4;//inductive reactance in ohms
8 Y=(inv(R)+inv(Xl));//admittance in mho
```

```

9 disp(Y);
10 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.31 RESONANT FREQUENCY

```

1 //Chapter -5, Example 5.31, Page 196
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 R=10; //resistance in ohms
7 L=10; //inductance in milli henry
8 C=1; //capacitance in uF
9 V=200; //applied voltage in volts
10 //CALCULATIONS
11 fr=1/(2*%pi*(sqrt(L*C*10^-3*10^-6))); //resonant
    frequency in hz
12 I0=V/(R); //current at resonance in A
13 Vr=I0*R; //voltage across resistance in volts
14 Xl=2*%pi*fr*L*10^-3; //inductance in ohms
15 Vl=I0*Xl; //voltage across inductor in volts
16 Xc=inv(2*%pi*fr*C*10^-6); //capacitance in ohms
17 Vc=I0*Xc; //voltage across capacitor in volts
18 wr=2*%pi*fr //angular resonant frequency in rad/sec
19 Q=(wr*L*10^-3)/(R); //quality factor
20 Bw=(fr/Q); //bandwidth in hz
21 mprintf("Thus resonant frequency and current are %4
    .2f hz and %d A respectively\n",fr,I0);
22 mprintf(" voltages across resistance, inductance and
    capacitance are %d V,%d V and %d V respectively\n
    ",Vr,Vl,Vc);

```

```

23 mprintf("bandwidth and quality factor are %3.2f hz
    and %d respectively",Bw,Q);
24 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.32 CIRCUIT CONSTANTS

```

1 //Chapter -5, Example 5.32, Page 196
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V=220;//applied voltage in volts
7 f=50;//frequency in hz
8 Imax=0.4;//maximum current in A
9 Vc=330;//voltage across capacitance in volts
10 //at resonance condition I0=0.4 A
11 I0=0.4//current in A
12 //CALCULATIONS
13 Xc=(Vc)/(I0);//capacitive reactance in ohms
14 C=inv(2*%pi*f*Xc);//capacitance in F
15 //at resonance condition Xc=Xl, hence
16 L=Xc/(2*%pi*f);//inductance in henry
17 R=V/(Imax);//resistance in ohms
18 mprintf("Thus resistance ,inductance and capacitance
    are %d ohms,%1.2f H and %g F respectively\n",R,L,
    C);
19 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.33 RESONANT FREQUENCY

```
1 //Chapter -5, Example 5.33, Page 197
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 R1=5; //resistance of branch1 in ohms
7 R2=2; //resistance of branch2 in ohms
8 L=10; //inductance in mH
9 C=40; //capacitance in uF
10 //CALCULATIONS
11 fr=(1/(2*%pi*(sqrt(L*C*10^-9))))*(sqrt((C*10^-6*(R1
    )^2)-L*10^-3)/((C*10^-6*(R2)^2)-L*10^-3)); //
    resonant frequency in hz
12 mprintf("Thus resonant frequency is %f hz",fr);
13 //=====END OF PROGRAM


---


```

### Scilab code Exa 5.34 FREQUENCY

```
1 //Chapter -5, Example 5.34, Page 197
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 R=20; //resistance in ohms
```

```

7 L=0.2; //inductance in H
8 C=100; //capacitance in uF
9 //resistance will be non-inductive only at resonant
  frequency
10 //CALCULATIONS
11 fr=(1/(2*pi*(sqrt(L*C*10^-6))))*(sqrt((L-(C*10^-6*(
  R)^2))/(L))); //resonant frequency in hz
12 mprintf("Thus resonant frequency is %2.2f hz\n",fr);
13 Rf=(L)/(C*R*10^-6); //non-inductive resistance
14 mprintf("Thus value of non-inductive resistance is
  %d ohms",Rf);
15 //=====END OF PROGRAM
  =====

```

---

### Scilab code Exa 5.35 BANDWIDTH

```

1 //Chapter -5, Example 5.35, Page 198
2 //
  =====

3 clc
4 clear
5 //INPUT DATA
6 Q=250; //quality factor
7 fr=1.5*10^6; //resonant freq in hertz
8 //CALCULATIONS
9 Bw=(fr)/(Q); //bandwidth in Hz
10 hf1=fr+Bw; //half power freq 1
11 hf2=fr-Bw; //half power freq 2
12 mprintf("Thus bandwidth is %d hz\n",Bw);
13 mprintf("Thus value of half-power frequencies are %g
  hz and %g hz",hf1,hf2);
14 //=====END OF PROGRAM
  =====

```

---

**Scilab code Exa 5.36 RESONANT FREQUENCY**

```
1 //Chapter -5, Example 5.36, Page 198
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 L=40*10-3; //inductance in henry
7 C=0.01*10-6; //capacitance in uf
8 //CALCULATIONS
9 fr=1/(2*%pi*sqrt(L*C)); //resonant frequency
10 mprintf("Thus resonant frequency is %d hz\n",fr);
11 //=====END OF PROGRAM


---


```

---

**Scilab code Exa 5.37 RESONANT FREQUENCY**

```
1 //Chapter -5, Example 5.37, Page 198
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V=120; //source voltage in volts
7 R=50; //resistance in ohms
8 L=0.5; //inductance in Henry
9 C=50; //capacitance in uF
```



```

10 //CALCULATIONS
11 //at Resonance
12 fr=(1/(2*%pi*(sqrt(L*C*10^-6)))); //resonant
    frequency in hz
13 I0=V/R; //current at resonance in A
14 V1=(%i)*(I0*L); //voltage developed across inductor
    in volts
15 Vc=(-%i)*(I0*L); //voltage developed across capacitor
    in volts
16 Q=(inv(R))*(sqrt(L/(C*10^-6))); //quality factor
17 Bw=(fr)/(Q); //Bandwidth in Hz
18 //given resonance is to occur at 300 rad/sec, then
19 wr=300; //wr=(2*%pi*f*r)----->measured in Hz
20 //wr=inv(sqrt(L*Cn))
21 Cr=inv(L*(wr)^2); //capacitance required in uF
22 mprintf("Thus resonant frequency, current, quality
    factor and bandwidth are %2.1f Hz, %1.1f A, %d and
    %2.1f hz respectively\n", fr, I0, Q, Bw);
23 mprintf("New value of capacitance at 300 rad/sec is
    %g F", Cr)
24 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.38 Q FACTOR

```

1 //Chapter -5, Example 5.38, Page 199
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 Q=45; //quality factor
7 f1=600*10^3; //freq in Hz

```

```

8 f2=1000*10^3;//freq in Hz
9 //given new resistance is 50% greater than former.
   let us consider two reistances as R1=1 ohm and R2
   =1.5 ohm for ease of calculation.Then
10 R1=1;//resistance in ohm
11 R2=1.5;//resistance in ohm
12 //CALCULATIONS
13 W1=2*%pi*f1;//angular freq 1 in rad/sec
14 W2=2*%pi*f2;//angular freq 2 in rad/sec
15 Q=45;//quality factor
16 L=(Q*R1)/(W1);//inductance in henry
17 Q1=(W2*L)/(R2);//new quality factor
18 mprintf("Thus new quality factor is %d",Q1);
19 //=====END OF PROGRAM

```

---

### Scilab code Exa 5.39 SINGLE PHASE AC CIRCUITS

```

1 //Chapter –5, Example 5.39 , Page 199
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 R=4;//resistance in ohm
7 L=100*10^-6;//inductance in henry
8 C=250*10^-12;//capacitance in Farads
9 //CALCULATIONS
10 fr=inv(2*%pi*sqrt(L*C));//resonant frequency in Hz
11 Q=(inv(R))*(sqrt(L/C));//Q-factor
12 Bw=fr/Q;//bandwidth in Hz
13 hf1=fr+Bw;//halfpower freq1 in Hz
14 hf2=fr-Bw;//halfpower freq2 in Hz

```

```

15 mprintf("Thus resonant freq ,Q-factor and new
    halfpower frequencies are %dhz ,%d,%g hz,%g hz
    respectively",fr,Q,hf1,hf2);
16 //note:given answers are wrong in textbook.Please
    check the answers
17 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 5.40 RESONANT FREQUENCY

```

1 //Chapter -5, Example 5.40, Page 200
2 //
    =====

3 clc
4 clear
5 //INPUT DATA
6 R=10;//resistance in ohm
7 L=10^-3;//inductance in henry
8 C=1000*10^-12;//capacitance in Farads
9 V=20;//voltage in volts
10 //CALCULATIONS
11 fr=inv(2*%pi*sqrt(L*C));//resonant frequency in Hz
12 Q=(inv(R))*(sqrt(L/C));//Q-factor
13 Bw=fr/Q;//bandwidth in Hz
14 hf1=fr+Bw;//halfpower freq1 in Hz
15 hf2=fr-Bw;//halfpower freq2 in Hz
16 mprintf("Thus resonant freq ,Q-factor and new
    halfpower frequencies are %d hz ,%d ,%g hz,%g hz
    respectively",fr,Q,hf1,hf2);
17 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 5.41 POWER

```
1 //Chapter -5, Example 5.41, Page 208
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 P1=1000; //power1 in watts
7 P2=1000; //power2 in watts
8 //CALCULATIONS
9 //for case(1)
10 Pt=P1+P2; //total power in watts
11 phi=atan(sqrt(3)*((P2-P1)/(P2+P1))*(180/%pi)); //
    since tan(phi)=sqrt(3)*((P2-P1)/(P2+P1))
12 pf=cos(phi);
13 mprintf("Thus power and powerfactor are %d W ,%d
    respectively\n",Pt,pf);
14 //for case(2)
15 P3=1000; //power3 in watts
16 P4=-1000; //power4 in watts
17 Pt1=P3+P4; //total power in watts
18 pf1=0; //since we cannot perform division by zero in
    scilab, it doesn't consider it as infinite
    quantity to yield 90 degree angle and hence
    powerfactor 0
19 mprintf("Thus power and powerfactor are %d W ,%d
    respectively",Pt1,pf1);
20 //=====END OF PROGRAM


---


```

### Scilab code Exa 5.42 REAL POWER

```
1 //Chapter -5, Example 5.42, Page 209
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V1=400; //voltage in volts
7 Z1=(3+((%i)*4)); //impedance in ohms
8 //CALCULATIONS
9 //in star connected system, phase voltage=(line
   voltage)
10 Ep=V1/(sqrt(3)); //voltage in volts
11 Ip=Ep/Z1; //current in A
12 ip1=abs(Ip); //line current in A
13 theta=atan((imag(Ip)/real(Ip)));
14 Pt=sqrt(3)*V1*ip1*cos(theta); //total power consumed
   in load in W
15 mprintf("Thus total power consumed in load is %f W",
   Pt);
16 //note:for line current the answer given is 46.02A
   instead of 46.2 A and hence total power consumed
   changes
17 //=====END OF PROGRAM


---


```

### Scilab code Exa 5.43 LINE TO NEUTRAL VOLTAGE

```
1 //Chapter -5, Example 5.43, Page 209
```

```

2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 V1=400;//voltage in volts
7 I1=10;//current in A
8 //CALCULATIONS
9 //in star connected system ,phase current=(line
    current)=I1
10 phase_voltage=(V1)/(sqrt(3));//voltage in Volts
11 mprintf("Thus phase voltage is %1.0f V",
    phase_voltage);
12 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 5.44 CURRENT

```

1 //Chapter -5, Example 5.44, Page 209
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Z1=(6-((%i)*8));//impedance1 in ohms
7 Z2=(16+((%i)*12));//impedance2 in ohms
8 I1=(12+((%i)*16));//current in A
9 //CALCULATIONS
10 V=I1*Z1;//applied voltage in volts
11 I2=V/(Z2);//current in other branch in A
12 mprintf("current in other branch in Amps")
13 disp(I2);

```

```

14 I=I1+I2;//total current in A
15 mprintf("total current in Amps");
16 disp(I);
17 i1=abs(I);//magnitude in A
18 i2=atan((imag(I)/real(I)));
19 P=V*i1*cos(i2);//power consumed in circuit
20 mprintf("Thus voltage applied and power consumed are
        %d V and %d W respectively",V,P);
21 //=====END OF PROGRAM

```

---

#### Scilab code Exa 5.45 THREE PHASE POWER

```

1 //Chapter –5, Example 5.45, Page 210
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V1=415;//voltage in volts
7 Z=(4+((%i)*6));//impedance in each phase in ohm
8 //CALCULATIONS
9 Ip=V1/Z;//current in each phase in A
10 ip1=abs(Ip);//magnitude of Ip
11 I1=(sqrt(3))*(ip1);//line current in A
12 phi=atan((imag(Ip)/real(Ip)))
13 P=(sqrt(3))*V1*I1*cos(phi);//power supplied in W
14 mprintf("Thus power supplied is %d W",P);
15 //note:the cosfunction of scilab and calculator will
        differ slightly
16 //=====END OF PROGRAM

```

---

---

**Scilab code Exa 5.46 IMPEDANCE**

```
1 //Chapter -5, Example 5.46 , Page 210
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V1=400;//voltage in volts
7 I1=20;//current in A
8 f=50;//freq in hz
9 pf=0.3//power factor
10 //CALCULATIONS
11 Ip=I1/sqrt(3);//phase current in A
12 Z=V1/Ip;//impedance in each phase in ohms
13 phi=acos(0.3);//angle in radians
14 Zb=Z*(cos(phi)+(%i)*sin(phi));//impedance connected
    in each phase
15 mprintf("Thus impedance connected in each phase in
    ohms");
16 disp(Zb);
17 //=====END OF PROGRAM


---


```

**Scilab code Exa 5.47 POWER**

```
1 //Chapter -5, Example 5.47 , Page 210
2 //


---


```



```

3  clc
4  clear
5  //INPUT DATA
6  P1=6*10^3; //power in Kw
7  P2=-1*10^3; //power in Kw
8  //CALCULATIONS
9  P=P1+P2; //total power in Kw
10 a=atan(sqrt(3)*((P2-P1)/(P2+P1)));
11 pf=cos(a); //power factor
12 mprintf("Thus power and power factor are %d W and %1
    .2f respectively",P,pf);
13 //=====END OF PROGRAM

```

---

#### Scilab code Exa 5.48 POWER FACTOR

```

1  //Chapter -5, Example 5.48, Page 211
2  //

```

---

```

3  clc
4  clear
5  //INPUT DATA
6  Z=3-((%i)*4); //impedance in ohms
7  V1=400; //line voltage in volts
8  //CALCULATIONS
9  Vp=V1/(sqrt(3)); //phase voltage in volts
10 Ip=Vp/abs(Z); //phase current in Amps
11 //line current(Il)=phase current(Ip)
12 Il=Ip; //line current in A
13 power_factor=cos(atan(imag(Z)/real(Z)));
14 power_consumed=sqrt(3)*V1*Il*power_factor;
15 mprintf("Thus power consumed and power factor are %f
    W and %1.1f respectively",power_consumed,

```

```

    power_factor);
16 //note:answer computed for power consumed in
    textbook is wrong.Please check the calculations
17 //=====END OF PROGRAM
=====

```

---

**Scilab code Exa 5.49 LINE TO NEUTRAL VOLTAGE**

```

1 //Chapter –5, Example 5.49, Page 211
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 I1=10;//current in Amps
7 V1=400;//line voltage in volts
8 //CALCULATIONS
9 Vp=V1/(sqrt(3));//line to neutral voltage
10 Ip=I1;//phase current in Amps
11 mprintf("Thus line to neutral voltage and phase
    current are %1.0f V and %d A respectively",Vp,Ip)
    ;
12 //=====END OF PROGRAM
=====

```

---

**Scilab code Exa 5.50 POWER**

```

1 //Chapter –5, Example 5.50, Page 211

```

```

2 //


---


3 clc
4 clear
5 //INPUT DATA
6 P1=2000; //power in watts
7 P2=1000; //power in watts
8 V1=400; //line voltage in volts
9 //CALCULATIONS
10 P=P1+P2; //power in Watts
11 a=sqrt(3*(P1-P2)/(P1+P2));
12 b=atan(sqrt(a));
13 power_factor=cos(b);
14 kVA=P/power_factor;
15 mprintf("Thus power,power factor and kVA are %d W ,
           %1.3f and %1.2f respectively",P,power_factor,kVA)
           ;
16 //note:computed value for powerfactor and kVA in
           textbook are wrong.Please check the calculations
17 //=====END OF PROGRAM


---



```

# Chapter 12

## JUNCTION DIODE AND ITS APPLICATIONS

Scilab code Exa 12.1 PEAK RMS AND AVERAGE CURRENT

```
1 //Chapter –12, Example 12.1, Page 341
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Vm=325;//voltage in volts
7 Rl=1000;//resistive load in ohms
8 rf=100;//forward resistance in ohms
9 //CALCULATIONS
10 //for subdivision (a)
11 Im=Vm/(rf+Rl);//peak value of current in A
12 Idc=Im/(%pi);//average current in A
13 Irms=Im/2;//rms value of current in A
14 mprintf("Thus peak value of current ,average current
    and rms value of current are %g A ,%g A and %g A
    respectively\n",Im,Idc, Irms);
15 //for subdivision (b)
```

```

16 Pdc=(Idc)^2*(Rl); //DC power output
17 mprintf("Thus DC power is %1.3 f W\n",Pdc);
18 //for subdivision (c)
19 Pac=(Irms)^2*(rf+Rl); //AC input power
20 mprintf("Thus AC power is %d W\n",Pac);
21 //for subdivision (d)
22 n=(Pdc/Pac); //efficiency of rectification
23 n=n*100; //efficiency in percentage
24 mprintf("Thus efficiency in percentage is %2.2 f
percentage",n);
25 //=====END OF PROGRAM
=====

```

---

#### Scilab code Exa 12.2 AC VOLTAGE

```

1 //Chapter –12, Example 12.2, Page 341
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Vdc=24; //supply voltage in volts
7 Rl=500; //resistance in ohms
8 rf=50; //forward resistance in ohms
9 //CALCULATIONS
10 Idc=(Vdc)/(Rl); //average value of load current in A
11 Im=(%pi)*(Idc); //maximum value of load current in A
12 Vm=(Im)*(rf+Rl); //Maximum voltage required at input
in volts
13 mprintf("Thus average current ,maximum current and
maximum voltage required are %g A,%g A and %2.2 f
V respectively",Idc,Im,Vm);
14 //=====END OF PROGRAM
=====

```

---

---

### Scilab code Exa 12.3 DC VOLTAGE

```
1 //Chapter –12, Example 12.3, Page 342
2 //
3 clc
4 clear
5 //INPUT DATA
6 Vac=230;//AC supply voltage
7 turnsratio=5;//turns ratio
8 Rl=300;//resistance in ohms
9 //CALCULATIONS
10 Vs=(Vac)/(turnsratio);//transformer secondary
    voltage in V
11 Vm=sqrt(2)*(Vs);//maximum value of secondary voltage
    in V
12 Vdc=Vm/(%pi);//DC output voltage in V
13 PIV=Vm;//PIV of a diode in V
14 Im=(Vm/Rl);//maximum value of load current in A
15 Pm=(Im)^2*(Rl);//Maximum value of power delivered
16 Idc=Vdc/(Rl);//average value of load current in A
17 Pdc=(Idc)^2*(Rl);//average value of power delivered
    to load
18 mprintf("Thus DC output voltage ,PIV,Maximum value of
    power delivered ,average value of power delivered
    to load are %2.1f V,%d V,%2.1f W,%1.2f W
    respectively" ,Vdc ,PIV ,Pm ,Pdc);
19 //=====END OF PROGRAM
```

---

---

### Scilab code Exa 12.4 DC VOLTAGE

```
1 //Chapter –12, Example 12.4 , Page 344
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Vac=230; //AC supply voltage
7 f=60; //frequency in Hz
8 Rl=900; //load resistance in ohms
9 noofturns=5; //no of turns
10 Rl=900; //resistance of load in ohms
11 rs=100; //secondary coil resistance in ohms
12 //CALCULATIONS
13 Vs=(Vac)/(noofturns); //voltage across two ends of
    secondary in V
14 Vrms=(Vs)/2; //voltage from center tapping to one end
15 Vm=Vrms*sqrt(2); //mean voltage in V
16 Vdc=(2*Vm)/(%pi); //voltage across load in V
17 Idc=(Vdc)/(rs+Rl); //DC current flowing through to
    load in A
18 Pdc=(Idc)^2*(Rl); //DC power delivered to the load in
    W
19 PIV=2*Vm; //PIV across each diode in V
20 Vr=sqrt((Vrms)^2-(Vdc)^2); //Ripple voltage in V
21 fr=2*f; //frequency of ripple voltage in Hz
22 mprintf("Thus voltage across load ,DC current flowing
    through to load ,DC power delivered to the load ,
    PIV across each diode ,Ripple voltage are %2.1f V,
    %g A,%1.3f W,%d V,%2.2f V and %d Hz respectively"
    ,Vdc ,Idc ,Pdc ,PIV ,Vr ,fr);
23 //=====END OF PROGRAM
```

---

---

### Scilab code Exa 12.5 RESISTANCE

```
1 //Chapter –12, Example 12.5, Page 344
2 //
3 clc
4 clear
5 //INPUT DATA
6 Imax=400*10-3; //maximum value of current in mA
7 Iav=150*10-3; //average value of current in mA
8 Vs=100; //maximum value of secondary voltage in V
9 //CALCULATIONS
10 //we know that maximum value of current does not
    exceed 80 percentage
11 Imax1=0.8*Imax; //maximum value of current in mA
12 Vm=sqrt(2)*(Vs); //maximum value of secondary voltage
    in V
13 Rl=(Vm)/(Imax1); //value of load resistor in ohms
14 Vdc=(2*Vm)/(%pi); //DC(load) voltage
15 Idc=Vdc/(Rl); //DC load current in A
16 PIV=2*Vm; //PIV of each diode
17 mprintf("Thus value of load resistor ,voltage ,current
    and PIV of each diode are %1.0f ohms,%d V,%1.3f
    A and %3.1f V respectively",Rl,Vdc,Idc,PIV);
18 //=====END OF PROGRAM
```

---

---

### Scilab code Exa 12.6 RIPPLE VOLTAGE



```

1 //Chapter –12, Example 12.6, Page 345
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 Pdc=50; //power in W
7 Rl=200; //resistance in ohms
8 ripplefactor=0.01
9 //CALCULATIONS
10 Vdc=sqrt(Pdc*Rl); //DC voltage
11 Vac=ripplefactor*Vdc; //AC voltage
12 mprintf("Thus AC ripple voltage across the load is
    %d V",Vac);
13 //=====END OF PROGRAM

```

---

#### Scilab code Exa 12.7 DC VOLTAGE

```

1 //Chapter –12, Example 12.7, Page 346
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V=230; //AC supply voltage
7 f=50; //frequency in Hz
8 noofturns=4; //noofturns ratio
9 Rl=600; //load resistance in ohms
10 //CALCULATIONS
11 Vrms=(V/4); //rms value of secondary voltage in V
12 Vm=sqrt(2)*(Vrms); //max value of secondary voltage

```

```

13 Vdc=(2*Vm)/(%pi); //DC output voltage
14 Pdc=(Vdc)^2/(Rl); //DC power in W
15 PIV=Vm; //PIV across each diode in V
16 f0=2*f; //output frequency in Hz
17 mprintf("Thus DC output voltage ,DC power ,PIV and
    output frequency are %1.0f V,%1.3f W,%2.1f V and
    %d hz respectively",Vdc,Pdc,PIV,f0);
18 //note:in given problem ,Rl is 600 ohms ,but in
    textbook calculations Rl taken is 1000 ohms ,I
    took Rl as 600 ohms
19 //=====END OF PROGRAM
    =====

```

---

#### Scilab code Exa 12.8 INDUCTANCE

```

1 //Chapter –12, Example 12.8 , Page 349
2 //
    =====

3 clc
4 clear
5 //INPUT DATA
6 Rl=100; //resistance of load in ohms
7 f=60; //frequency in hz
8 ripplefactor=0.04;
9 //CALCULATIONS
10 L=Rl/(3*sqrt(2)*(2*%pi*f*ripplefactor)); //inductance
11 mprintf("inductance is %1.4f H",L);
12 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 12.9 CAPACITANCE

```
1 //Chapter –12, Example 12.9, Page 351
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Rl=500;//resistance of load in ohms
7 f=400;//frequency in hz
8 ripplefactor=0.1;
9 //CALCULATIONS
10 C=inv(4*sqrt(3)*f*Rl*ripplefactor);//capacitance in
    uF
11 mprintf("thus capacitance is %g F",C);
12 //note:ripple factor is 0.1 not 0.01 as mentioned by
    problem in text book
13 //=====END OF PROGRAM


---


```

### Scilab code Exa 12.10 FILTER DESIGN

```
1 //Chapter –12, Example 12.10, Page 352
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V=10;//output voltage in V
7 I1=200*10-3;//load current in A
8 //CALCULATIONS
9 Rl=V/(I1);//effective load resistance in ohms
```

```

10 ripplefactor=0.02;
11 //critical value occurs at f=50 hz
12 f=50;//freq in hz
13 L=R1/(3*2*%pi*f);//inductance in H
14 //but taking L=60mh(about 20 percentage higher)we
    have
15 L1=60*10^-3;//inductance in henry
16 C=1.194/(ripplefactor*L1);
17 mprintf("the values of L and C for LC filter are %g
    H and %g F respectively",L1,C)
18 //note:C value calculated is wrong in textbook
19 //=====END OF PROGRAM

```

---

### Scilab code Exa 12.11 CLC

```

1 //Chapter -12, Example 12.11, Page 353
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 V=10;//output voltage in V
7 I1=200*10^-3;//load current in A
8 ripplefactor=0.02;
9 //CALCULATIONS
10 R1=V/(I1);//resistance in ohms
11 //if we assume L=10H and C1=C2=C
12 L=10;//indcutance in henry
13 C=sqrt(5700/(L*50*ripplefactor));
14 mprintf("the values of L and C for CLC section are
    %d H and %1.0f uF respectively",L,C)
15 //=====END OF PROGRAM

```

---

---

### Scilab code Exa 12.16 VOLTAGE

```
1 //Chapter –12, Example 12.16 , Page 363
2 //
3 clc
4 clear
5 //The frequency of given input signal is 2000 hz.
   Hence, the period of the signal is 0.5ms. During
   the negative half of the signal, the diode is
   forward biased and it acts like a short circuit
   and the capacitor charges to 20 V. This can be
   found out by applying Kirchoff's law in the input
   side.
6 //15+Vc-5=0;
7 //and
8 //Vc=20 V
9 //The voltage across the resistor will be equal to
   Dc voltage 5V
10 //During the positive half of input signal, the diode
   is reverse biased and it acts like an open
   circuit. Hence, the 5V battery has no effect on V0.
   Applying Kirchoff's voltage law around the
   outside loop, we get
11 //15+20-Vo=0
12 //Vo=35V
13 mprintf(" Vc=20V\n")
14 mprintf("the voltage across resistor will be equal
   to 5V")
15 //=====END OF PROGRAM
```

---

---

---

**Scilab code Exa 12.17 VOLTAGE**

```
1 //Chapter –12, Example 12.17, Page 364
2 //


---


3 clc
4 clear
5 //During the negative half of the input signal ,the
   diode conducts ,and acts like a short circuit.Now,
   the output voltage ,V0=0V.The capacitor is charged
   to 10V with polarities and it behaves like a
   battery.
6 //During the positive half of the input signal ,the
   diode does not conduct ,and acts like an open
   circuit.Hence,the output voltage ,V0=20V.This
   gives positively clamped voltage.
7 mprintf("V0=10+10=20 V")
8 //=====END OF PROGRAM


---


```

---

**Scilab code Exa 12.18 VOLTAGE**

```
1 //Chapter –12, Example 12.18, Page 365
2 //


---


3 clc
4 clear
```

```

5 //During the positive half of the input signal ,the
   diode conducts and acts like a short circuit.Now,
   the output voltage ,V0=0V.The capacitor is charged
   to 12V with polarities and it behaves like a
   battery .
6 //during the negative half of the input signal ,the
   diode does not conduct and acts like an open
   circuit.Hence the output voltage ,V0=-24V.This
   gives negatively clamped voltage .
7 mprintf("V0=0V\n")
8 mprintf("output voltage V0=-24V")
9 //=====END OF PROGRAM

```

---

#### Scilab code Exa 12.19 ELECTRON MOBILITY

```

1 //Chapter -12, Example 12.19, Page 367
2 //
3 clc
4 clear
5 //INPUT DATA
6 Rh=200;//Hall-coefficient in cubiccentimeter/C
7 a=10;//conductivity in s/m
8 //CALCULATIONS
9 un=a*Rh;//electron mobility in cm^2/V-s
10 mprintf("electron mobility is %d cm^2/V-s",un)
11 //note:answer given is wrong in textbook
12 //=====END OF PROGRAM

```

---

### Scilab code Exa 12.20 ELECTRON CONCENTRATION

```
1 //Chapter -12, Example 12.20, Page 367
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 a=10; //conductivity in s/m
7 un=50*10-4; //electron mobility in m2/V-s
8 q=1.6*10-19; //charge in coulombs
9 //CALCULATIONS
10 n=(a/(un*q)); //electron concentration in m-3
11 mprintf("electron concentration is %g m-3 ",n)
12 //=====END OF PROGRAM
```

---

### Scilab code Exa 12.21 ELECTRON DENSITY

```
1 //Chapter -12, Example 12.21, Page 368
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 I=20; //current in A
7 B=1.2 //magnetic flux density in Wb/m2
8 Vh=60; //hall voltage in V
9 w=0.5; //thickness of strip in mm
```



```
10 q=1.6*10^-19; //charge in coulombs
11 //CALCULATIONS
12 n=(B*I)/(Vh*q*w*10^-3); //electron concentration in m
    ^-3
13 mprintf("electron density is %g m^3 ",n)
14 //=====END OF PROGRAM
=====
```

---

# Chapter 13

## TRANSISTOR AND OTHER DEVICES

Scilab code Exa 13.1 BASE CURRENT

```
1 //Chapter –13, Example 13.1, Page 388
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Ie=10;//emitter current in mA
7 Ic=9.8;//collector current in mA
8 //CALCULATIONS
9 Ib=Ie-Ic;//base current in mA
10 mprintf("base current is %1.1f mA ",Ib)
11 //=====END OF PROGRAM


---


```

### Scilab code Exa 13.2 CURRENT GAIN

```
1 //Chapter –13, Example 13.2, Page 389
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Ie=6.28;//emitter current in mA
7 Ic=6.20;//collector current in mA
8 //CALCULATIONS
9 a=(Ic/Ie);//current gain
10 mprintf("current gain is %1.3f",a)
11 //=====END OF PROGRAM


---


```

### Scilab code Exa 13.3 BASE CURRENT

```
1 //Chapter –13, Example 13.3, Page 389
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 a=0.967//common–base DC current gain
7 Ie=10;//emitter current in mA
8 //CALCULATIONS
9 Ic=Ie*a;//collector current in mA
10 Ib=Ie-Ic;//base current in mA
11 mprintf("base current is %1.2f mA",Ib)
12 //=====END OF PROGRAM


---


```

---

**Scilab code Exa 13.4 COLLECTOR CURRENT**

```
1 //Chapter -13, Example 13.4, Page 389
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 a=0.98//common-base DC current gain
7 Ie=10;//emitter current in mA
8 //CALCULATIONS
9 Ic=Ie*a;//collector current in mA
10 Ib=Ie-Ic;//base current in mA
11 mprintf("base current is %1.1f mA",Ib)
12 //=====END OF PROGRAM
```

---

**Scilab code Exa 13.5 CURRENT GAIN**

```
1 //Chapter -13, Example 13.5, Page 389
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 a=0.97//common-base DC current gain
7 b=200;//common-emitter DC current gain
8 //CALCULATIONS
```

```

9  b1=a/(1-a); //common-emitter DC current gain when a
    =0.97
10 a1=b/(b+1); //common-base DC current gain when b=200
11 mprintf("Thus common-emitter DC current gain when a
    =0.97 and common-base DC current gain when b=200
    are %2.2f and %1.3f respectively ",b1,a1)
12 //=====END OF PROGRAM

```

---

#### Scilab code Exa 13.6 EMITTER CURRENT

```

1  //Chapter -13, Example 13.6, Page 389
2  //

```

---

```

3  clc
4  clear
5  //INPUT DATA
6  Ic=40; //collector current in mA
7  b=100; //common-emitter DC current gain
8  //CALCULATIONS
9  Ib=Ic/b; //base current in mA
10 Ie=Ib+Ic; //emitter current in mA
11 mprintf("Thus emitter current is %2.1f mA",Ie);
12 //=====END OF PROGRAM

```

---

#### Scilab code Exa 13.7 COLLECTOR CURRENT

```

1  //Chapter -13, Example 13.7, Page 390

```

```

2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Ie=10; //emitter current in mA
7 b=150; //common-emitter DC current gain
8 //CALCULATIONS
9 a=b/(b+1); //common-base DC current gain
10 Ic=a*Ie; //collector current in mA
11 Ib=Ie-Ic; //base current in mA
12 mprintf("Thus collector and base currents are %1.2f
    mA and %1.2f mA respectively",Ic,Ib);
13 //=====END OF PROGRAM
=====

```

---

**Scilab code Exa 13.8 BASE CURRENT**

```

1 //Chapter-13, Example 13.8, Page 390
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Ic=80; //collector current in mA
7 b=170; //common-emitter DC current gain
8 //CALCULATIONS
9 Ib=Ic/b; //base current in mA
10 Ie=Ib+Ic; //emitter current in mA
11 mprintf("Thus emitter and base currents are %2.2f mA
    and %1.2f mA respectively",Ie,Ib);
12 //=====END OF PROGRAM

```

---

---

**Scilab code Exa 13.9 COLLECTOR CURRENT**

```
1 //Chapter -13, Example 13.9, Page 390
2 //
3 clc
4 clear
5 //INPUT DATA
6 Ib=0.125; //base current in mA
7 b=200; //common-emitter DC current gain
8 //CALCULATIONS
9 Ic=b*Ib; //collector current in mA
10 Ie=Ib+Ic; //emitter current in mA
11 mprintf("Thus emitter and collector currents are %2
        .3f mA and %d mA respectively",Ie,Ic);
12 //=====END OF PROGRAM
```

---

**Scilab code Exa 13.10 COLLECTOR CURRENT**

```
1 //Chapter -13, Example 13.10, Page 391
2 //
3 clc
4 clear
5 //INPUT DATA
6 Ie=12; //emitter current in mA
```

```

7 b=100; //common-emitter DC current gain
8 //CALCULATIONS
9 Ib=Ie/(1+b); //base current in mA
10 Ic=Ie-Ib; //collector current in mA
11 mprintf("Thus base and collector currents are %1.4f
    mA and %2.4f mA respectively",Ib,Ic);
12 //=====END OF PROGRAM

```

---

### Scilab code Exa 13.11 COMMON EMITTER CURRENT GAIN

```

1 //Chapter -13, Example 13.11, Page 391
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 Ib=100*10^-6; //base current in A
7 Ic=2*10^-3; //collector current in A
8 Ib1=125*10^-6; //base current in A when change in Ib
    is 25 A
9 Ic1=2.6*10^-3; //collector current in A when change
    in Ic is 0.6 A
10 //CALCULATIONS
11 b=Ic/Ib; //common-emitter DC current gain
12 a=(b)/(b+1); //common-base DC current gain
13 Ie=Ib+Ic; //emitter current in A
14 b1=Ic1/Ib1; //new common-emitter DC current gain
15 mprintf("Thus b a and Ie of transistor are %d ,%1.3
    f and %g A respectively\n",b,a,Ie);
16 mprintf("new value of b is %2.1f",b1)
17 //=====END OF PROGRAM

```

---



---

**Scilab code Exa 13.12 COLLECTOR CURRENT**

```
1 //Chapter -13, Example 13.12, Page 391
2 //
=====
3 clc
4 clear
5 //INPUT DATA
6 a=0.98//common-base DC current gain
7 Icbo=5*10^-6;//current in A
8 Ib=100*10^-6;//base current in A
9 //CALCULATIONS
10 Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current
    in mA
11 Ie=Ib+Ic;//emitter current in mA
12 mprintf("Thus collector and emitter currents are %g
    A and %g A respectively",Ic,Ie);
13 //=====END OF PROGRAM
=====
```

---

**Scilab code Exa 13.13 COLLECTOR CURRENT**

```
1 //Chapter -13, Example 13.13, Page 391
2 //
=====
3 clc
4 clear
5 //INPUT DATA
```

```

6 Icbo=10*10^-6; //current in A
7 hfe=50; //common-emitter DC current gain
8 Ib=0.25*10^-3; //base current in A
9 T2=50; //temperature in degree centigrade
10 T1=27; //temperature in degree centigrade
11 //CALCULATIONS
12 Ic1=(hfe*Ib)+((1+hfe)*(Icbo)); //collector current in
    A when base current is Ib=0.25*10^-3
13 I1cbo=Icbo*(2*(T2-T1)/10); //new value of Icbo when
    temperature changes from 27 degree centigrade to
    50 degree centigrade
14 Ic2=(hfe*Ib)+((1+hfe)*(I1cbo)); //collector current
    in A
15 mprintf("Thus collector currents in case 1 and 2 are
    %g A ,%g A respectively",Ic1,Ic2);
16 //=====END OF PROGRAM

```

---

#### Scilab code Exa 13.14 CURRENT GAIN

```

1 //Chapter -13, Example 13.14, Page 391
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 deltaIe=1*10^-3; //change in emitter current in A
7 deltaIc=0.99*10^-3; //change in collector current in
    A
8 //CALCULATIONS
9 a=(deltaIc/deltaIe); //current gain of the transistor
10 mprintf("Thus current gain of the transistor is %1.2
    f",a);

```

```
11 //=====END OF PROGRAM
=====
```

---

#### Scilab code Exa 13.15 CURRENT GAIN

```
1 //Chapter -13, Example 13.15, Page 391
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 b=100;//common-emitter DC current gain
7 //CALCULATIONS
8 a=(b/(1+b));//common-base DC current gain
9 mprintf("Thus common-base DC current gain is %1.2f",
    a);
10 //=====END OF PROGRAM
=====
```

---

#### Scilab code Exa 13.16 CURRENT GAIN

```
1 //Chapter -13, Example 13.16, Page 391
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 deltaIe=1*10^-3;//change in emitter current in A
```

```

7 deltaIc=0.995*10^-3; //change in collector current in
  A
8 //CALCULATIONS
9 a=deltaIc/deltaIe; //common-base DC current gain
10 b=a/(1-a); //common-emitter DC current gain
11 mprintf("Thus common-base DC current gain and common
  -emitter DC current gain are %1.3f and %1.0f
  respectively",a,b);
12 //=====END OF PROGRAM
  =====

```

---

#### Scilab code Exa 13.17 BASE CURRENT

```

1 //Chapter -13, Example 13.17, Page 391
2 //
  =====
3 clc
4 clear
5 //INPUT DATA
6 b=49; //common-emitter DC current gain
7 Ie=3*10^-3; //emitter current in A
8 //CALCULATIONS
9 a=b/(1+b); //common-base DC current gain
10 Ic=a*Ie; //collector current in A
11 mprintf("Thus common-base DC current gain and
  ccollector current are %1.2f and %g A
  respectively",a,Ic);
12 //=====END OF PROGRAM
  =====

```

---

### Scilab code Exa 13.18 COLLECTOR CURRENT

```
1 //Chapter -13, Example 13.18, Page 393
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Ib=15*10^-3; //base current in A
7 b=150; //common-emitter DC current gain
8 //CALCULATIONS
9 Ic=b*Ib; //collector current in A
10 Ie=Ic+Ib; //emitter current in A
11 a=b/(1+b); //common-base DC current gain
12 mprintf("Thus collector current, emitter current and
    common-base DC current gain are %g A, %g A and
    %1.4f respectively", Ic, Ie, a);
13 //=====END OF PROGRAM


---


```

### Scilab code Exa 13.19 BASE CURRENT

```
1 //Chapter -13, Example 13.19, Page 393
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 Vcc=10; //collector to collector voltage in volts
7 Vbb=4; //base to base voltage in volts
8 Rb=200*10^3; //base resistance in ohms
9 Rc=2*10^3; //collector resistance in ohms
```

```

10 Vbe=0.7; //base to emitter voltage in volts
11 b=200; //common-emitter DC current gain
12 //CALCULATIONS
13 Ib=(Vbb-Vbe)/(Rb); //base current in A
14 Ic=b*Ib; //collector current in A
15 Ie=Ic+Ib; //emitter current in A
16 Vce=Vcc-(Ic*Rc); //collector to emitter voltage in
    volts
17 mprintf("Thus collector current ,emitter current and
    base currents are %g A,%g A and %g A respectively
    \n",Ib,Ic,Ie);
18 mprintf("collector to emitter voltage is %1.1f V",
    Vce)
19 //=====END OF PROGRAM

```

---

### Scilab code Exa 13.20 COLLECTOR CURRENT

```

1 //Chapter -13, Example 13.20, Page 394
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 a=0.99; //common-base DC current gain
7 Icbo=5*10^-6; //current in A
8 Ib=20*10^-6; //current in A
9 //CALCULATIONS
10 Ic=((a*Ib)/(1-a))+(Icbo/(1-a)); //collector current
    in A
11 Ie=Ib+Ic; //emitter current in A
12 mprintf("collector and emitter currents are %g A
    and %g A respectively",Ic,Ie)

```

```
13 //=====END OF PROGRAM
```

---

### Scilab code Exa 13.21 CURRENT GAIN

```
1 //Chapter -13, Example 13.21, Page 394
2 //
3 clc
4 clear
5 //INPUT DATA
6 Icbo=0.2*10^-6;//current in A
7 Iceo=18*10^-6;//current in A
8 Ib=30*10^-6;//current in A
9 //CALCULATIONS
10 a=1-(Icbo/Iceo);//common-base DC current gain
11 b=(Iceo/Icbo)-1;//common-emitter DC current gain
12 Ic=(b*Ib)+((1+b)*(Icbo));//collector current in A
13 mprintf("Thus common-base DC current gain and common
    -emitter DC current gain are %1.3f and %d
    respectively",a,b)
14 //=====END OF PROGRAM
```

---

### Scilab code Exa 13.22 EMITTER CURRENT

```
1 //Chapter -13, Example 13.22, Page 394
2 //
```

---

```
3  clc
4  clear
5  //INPUT DATA
6  a=0.99; //common-base DC current gain
7  Icbo=50*10-6; //current in A
8  Ib=1*10-3; //current in A
9  //CALCULATIONS
10 Ic=((a*Ib)/(1-a))+(Icbo/(1-a)); //collector current
    in A
11 Ie=Ic+Ib; //emitter current in A
12 mprintf("Thus emitter current is %g A",Ie)
13 //=====END OF PROGRAM
```

---



# Chapter 14

## INTEGRATED CIRCUITS

Scilab code Exa 14.1 COMMONMODE GAIN

```
1 //Chapter -14, Example 14.1, Page 456
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 CMRR=10^5; //common-mode rejection ratio
7 Ad=10^5; //differential gain
8 //CALCULATIONS
9 Acm=Ad/(CMRR); //common mode gain
10 mprintf("common-mode gain is %d",Acm);
11 //=====END OF PROGRAM


---


```

Scilab code Exa 14.2 SLEWRATE

```

1 //Chapter -14, Example 14.2, Page 458
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V0=20;//voltage in volts
7 t=4;//time in microsec
8 //SLEW RATE
9 SR=(V0)/t;//slewrates in V/us
10 mprintf("slewrates is %d V/us",SR);
11 //=====END OF PROGRAM


---



```

### Scilab code Exa 14.3 FREQUENCY

```

1 //Chapter -14, Example 14.3, Page 458
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 A=50;//gain of inverting amplifier
7 Vid=20*10^-3;//voltage in V
8 SR=0.5;//slewrates in V/us————>SR=(2*%pi*f*Vm)
   /(10^6)
9 //CALCULATIONS
10 Vm=A*(Vid);//maximum output voltage in V
11 fmax=(SR*10^6)/(2*%pi*Vm);//frequency in hz
12 mprintf("thus maximum frequency of the input for
   which undistorted output is obtained is %g hz",
   fmax);

```

```
13 //=====END OF PROGRAM
```

---

#### Scilab code Exa 14.4 PEAK TO PEAK VOLTAGE

```
1 //Chapter -14, Example 14.4, Page 458
2 //
3 clc
4 clear
5 //INPUT DATA
6 A=10; //gain of inverting amplifier
7 f=40*103; //frequency in hz
8 SR=0.5; //slewrate in V/us————>SR=(2*%pi*f*Vm)
   /(106)
9 //CALCULATIONS
10 Vm=(SR*106)/(2*%pi*f); //maximum output voltage in V
   peak
11 Vm=2*Vm; //maximum output voltage in V peak to peak
12 Vid=Vm/A; //maximum peak-to-peak input voltage for
   undistorted output
13 mprintf("Thus maximum peak-to-peak input voltage for
   undistorted output is %1.3f V peak-to-peak",Vid)
   ;
14 //=====END OF PROGRAM
```

---

#### Scilab code Exa 14.5 VOLTAGE GAIN

```
1 //Chapter -14, Example 14.5, Page 465
```

```

2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Rf=10*10^3;//feedback resistance in ohms
7 R1=1*10^3;//resistance in ohms
8 //CALCULATIONS
9 Af=-(Rf/R1);//closed-loop voltage gain for inverting
  amplifier
10 mprintf("Thus closed-loop voltage gain is %d",Af);
11 //=====END OF PROGRAM
=====

```

---

**Scilab code Exa 14.6 VOLTAGE GAIN**

```

1 //Chapter-14, Example 14.6, Page 466
2 //
=====

3 clc
4 clear
5 //INPUT DATA
6 Rf=10*10^3;//forward resistance in ohms
7 R1=1*10^3;//resistance in ohms
8 //CALCULATIONS
9 Af=1+(Rf/R1);//closed-loop voltage gain in non-
  inverting amplifier
10 b=(R1/(R1+Rf));//feedback factor
11 mprintf("Thus closed-loop voltage gain and feedback
  factor are %d and %1.3f respectively",Af,b);
12 //=====END OF PROGRAM
=====

```

---

Scilab code Exa 14.7 OUTPUT VOLTAGE

```
1 //Chapter -14, Example 14.7, Page 473
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 V1=2; //input voltage 1 of summing amplifier in V
7 V2=3; //input voltage 2 of summing amplifier in V
8 V3=4; //input voltage 3 of summing amplifier in V
9 R1=1; //resistance 1 of summing amplifier in kilo
    ohms
10 R2=1; //resistance 2 of summing amplifier in kilo
    ohms
11 R3=1; //resistance 3 of summing amplifier in kilo
    ohms
12 Rf=1; //feedback resistance in kilo ohms
13 R=1; //resistance in kilo ohms
14 //CALCULATIONS
15 V0=(-Rf/R)*(V1+V2+V3); //output voltage in volts
16 mprintf("Thus output voltage is %d V",V0);
17 //=====END OF PROGRAM


---


```

# Chapter 15

## DIGITAL ELECTRONICS

Scilab code Exa 15.1 DEC TO OCT

```
1 //Chapter –15, Example 15.1, Page 492
2 //


---


3 clc
4 clear
5 //INPUT DATA
6 x=12;//in decimal form
7 //CALCULATIONS
8 y=dec2oct(x);//converting to octal form
9 mprintf("Thus octal number is");
10 disp(y);
11 //=====END OF PROGRAM
```

---

Scilab code Exa 15.2 OCT TO DEC

```

1 //Chapter -15, Example 15.2, Page 492
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 x1=444; //in octal form
7 x2=237; //in octal form
8 x3=120; //in octal form
9 //CALCULATIONS
10 x1=base2dec(['444','237','120'],8) //converting octal
    to decimal
11 disp(x1);
12 //=====END OF PROGRAM

```

---

### Scilab code Exa 15.3 DEC TO HEX

```

1 //Chapter -15, Example 15.3, Page 493
2 //

```

---

```

3 clc
4 clear
5 //INPUT DATA
6 x1=112; //in decimal form
7 x2=253; //in decimal form
8 //CALCULATIONS
9 y1=dec2base(x1,16) //converting decimal to
    hexadecimal
10 y2=dec2base(x2,16) //converting decimal to
    hexadecimal
11 disp(y1);

```

```
12 disp(y2);
13 //=====END OF PROGRAM
=====
```

---

#### Scilab code Exa 15.4 HEX TO DEC

```
1 //Chapter –15, Example 15.4, Page 494
2 //
=====

3 clc
4 clear
5 //CALCULATIONS
6 x1=base2dec(['4AB', '23F'],16)//converting
    hexadecimal to decimal
7 disp(x1);
8 //=====END OF PROGRAM
=====
```

---

#### Scilab code Exa 15.5 MULTIPLICATION OF BINARY NUMBERS

```
1 //Chapter –15, Example 15.5, Page 496
2 //
=====

3 clc
4 clear
5 //CALCULATIONS
6 x1=base2dec(['1101', '1100'],2)//converting binary to
    decimal
```



```

7 x2=base2dec(['1000','101'],2)//converting binary to
  decimal
8 x3=base2dec(['1111','1001'],2)//converting binary to
  decimal
9 y1=(x1(1))*(x1(2));//multiplying
10 y2=(x2(1))*(x2(2));//multiplying
11 y3=(x3(1))*(x3(2));//multiplying
12 z1=dec2base(y1,2)//converting decimal to hexadecimal
13 z2=dec2base(y2,2)//converting decimal to hexadecimal
14 z3=dec2base(y3,2)//converting decimal to hexadecimal
15 disp(z1)
16 disp(z2)
17 disp(z3)
18 //=====END OF PROGRAM

```

---

#### Scilab code Exa 15.6 DIVISION OF BINARY

```

1 //Chapter –15, Example 15.6, Page 497
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 x1=base2dec(['110','10'],2)//converting binary to
  decimal
7 x2=base2dec(['1111','110'],2)//converting binary to
  decimal
8 y1=(x1(1))/(x1(2));//dividing
9 y2=(x2(1))/(x2(2));//dividing
10 z1=dec2base(y1,2);//converting decimal to binary
11 [f,e]=frexp(y2);//separting exponent and mantissa
12 disp(f)//mantissa

```

```

13 disp(e)//exponent
14 f=f*2;
15 g=floor(f);//rounding to nearest integer
16 disp(g);
17 z2=dec2base(e,2);//converting decimal to binary
    ----->before point part of resultant binary
    number
18 disp(z2)
19 g1=dec2base(g,2);//converting decimal to binary
    ----->after point part of resultant binary
    number
20 disp(g1)
21 //NOTE:here floating point decimal cannot be
    directly converted to binary for second case.
    Hence computed to binary
22 //=====END OF PROGRAM
    =====

```

---

### Scilab code Exa 15.7 SUBTRACTION OF BINARY NUMBERS

```

1 //Chapter –15, Example 15.7, Page 497
2 //
    =====

3 clc
4 clear
5 //CALCULATIONS
6 //using 1's complement method
7 x1=base2dec(['1111'],2)//converting binary to
    decimal
8 x=bin2dec('1010')
9 x2=dec2bin(bitcmp(x,4))//1's complement of a number
10 disp(x2)
11 x3=base2dec([x2],2)

```

```

12 x4=x1+x3;
13 x5=dec2base(x4,2)//converting decimal to hexadecimal
14 disp(x5)
15 y=15;
16 z=bitand(x4,y);//eliminating carry
17 z1=bitset(z,1);//setting 1st bit to 1
18 z2=dec2base(z1,2)//converting decimal to binary
19 disp(z2)
20 //using normal method
21 a=base2dec(['1111','1010'],2);//converting binary to
    decimal
22 b=a(1)-a(2);//subtraction
23 c=dec2base(b,2)//converting decimal to binary
24 disp(c)
25 //=====END OF PROGRAM

```

---

### Scilab code Exa 15.8 SUBTRACTION OF BINARY NUMBERS

```

1 //Chapter-15, Example 15.8, Page 498
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 //using 1's complement method
7 x1=base2dec(['1000'],2)//converting binary to
    decimal
8 x=bin2dec('1010')
9 x2=dec2bin(bitcmp(x,4))//1's complement of a number
10 disp(x2)
11 x3=base2dec([x2],2)
12 x4=x1+x3;

```

```

13 x5=dec2base(x4,2)//converting decimal to hexadecimal
14 disp(x5)
15 y=15;
16 z=bitand(x4,y);//eliminating carry
17 z2=dec2base(z,2)//converting decimal to binary
18 disp(z2)
19 //using normal method
20 a=base2dec(['1000','1010'],2);//converting binary to
    decimal
21 b=a(2)-a(1);//subtraction
22 c=dec2base(b,2)//converting decimal to binary
23 disp(c);//since we cannot use dec2base for negative
    integers,we cannot do (a(1)-a(2)) but we can do (
    a(2)-a(1)),with '-' sign added before the result.
    hence 'c' here is actually -'c'
24 //=====END OF PROGRAM

```

---

### Scilab code Exa 15.9 SUBTRACTION OF BINARY NUMBERS

```

1 //Chapter -15, Example 15.9, Page 497
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 //using 1's complement method
7 x1=base2dec(['1111'],2)//converting binary to
    decimal
8 x=bin2dec('1010')
9 x2=dec2bin(bitcmp(x,4))//1's complement of a number
10 disp(x2)
11 x3=base2dec([x2],2)

```

```

12 x4=x1+x3+1;
13 x5=dec2base(x4,2)//converting decimal to hexadecimal
14 disp(x5)
15 y=15;
16 z=bitand(x4,y);//eliminating carry
17 z2=dec2base(z,2)//converting decimal to binary
18 disp(z2)
19 //using normal method
20 a=base2dec(['1111','1010'],2);//converting binary to
    decimal
21 b=a(1)-a(2);//subtraction
22 c=dec2base(b,2)//converting decimal to binary
23 disp(c)
24 //=====END OF PROGRAM

```

---

#### Scilab code Exa 15.10 SUBTRACTION OF BINARY NUMBERS

```

1 //Chapter –15, Example 15.10, Page 497
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 //using 1's complement method
7 x1=base2dec(['1000'],2)//converting binary to
    decimal
8 x=bin2dec('1010')
9 x2=dec2bin(bitcmp(x,4))//1's complement of a number
10 disp(x2)
11 x3=base2dec([x2],2)
12 x4=x1+x3+1;
13 x5=dec2base(x4,2)//converting decimal to hexadecimal

```

```

14 disp(x5)
15 //using normal method
16 a=base2dec(['1000','1010'],2); //converting binary to
    decimal
17 b=a(2)-a(1); //subtraction
18 c=dec2base(b,2) //converting decimal to binary
19 disp(c)
20 //since we cannot use dec2base for negative integers
    ,we cannot do (a(1)-a(2)) but we can do (a(2)-a
    (1)),with '-' sign added before the result.hence
    'c' here is actually -'c'
21 //=====END OF PROGRAM

```

---

#### Scilab code Exa 15.11 ADD BCD NUMBERS

```

1 //Chapter -15, Example 15.11, Page 500
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 x1=base2dec(['1001'],2) //converting binary to
    decimal
7 x2=base2dec(['0100'],2) //converting binary to
    decimal
8 x3=x1+x2;
9 if(x3>9)
10     x3=x3+6;
11     z1=dec2base(x3,2) //converting decimal to binary
12 else
13     z1=dec2base(x3,2) //converting decimal to binary
14 end

```

```

15 disp(z1)
16 //note:last 4 bits represent 3 and 5th bit prefixed
    with 3 bits will look as 1.hence the combined
    result will be 13
17 //=====END OF PROGRAM

```

---

### Scilab code Exa 15.12 LAWS OF BOOLEAN ALGEBRA

```

1 //Chapter –15, Example 15.12, Page 502
2 //

```

---

```

3 clc
4 clear
5 //CALCULATIONS
6 disp('given=> Y=(A+AB)')
7 //given in the question//
8 disp('Y=A(1+B)')//by distributive law
9 disp('A.1')//by law 2
10 disp('A')//by law 4
11 disp('given=> Y=(A+A'B)')
12 disp('(A+A').(A+B)')//by distributive law
13 disp('1.(A+B)')//by law 6
14 disp('A+B')//by law 4
15 disp('given=>(AB+A'C+BC)')
16 disp('AB+A'C+BC(A+A')')
17 disp('AB+A'C+ABC+A'BC')
18 disp('AB(1+C)+A'C(1+B)')//by consensus theorem
19 disp('AB+A'C')
20 //=====END OF PROGRAM

```

---

### Scilab code Exa 15.13 SIMPLIFICATION

```

1 //Chapter -15, Example 15.13, Page 503
2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 //for (a)
7 disp('given=> Y=(A+AB+AB''C)')
8 disp('Y=A+AB''C')//by (A+AB=A)----->step 1
9 disp('A(A+B''C)')//by distributive law----->step
  2
10 disp('A(1.(1+B''C))')//by talking A as common
   ----->step 3
11 disp('A.1=A')//by 1+B''C=1----->step 4
12 //for (b)
13 disp('given=> Y=(A''+B)C+ABC')
14 disp('A''C+BC+ABC')//by distributive law----->
   step 1
15 disp('A''C+BC(1+A)')//by taking BC as common
   ----->step 2
16 disp('A''C+BC')//by rule 2 ----->step 3
17 disp('C(A''+B)')//taking C as common term----->
   step 4
18 //for (c)
19 disp('given=> Y=(AB''BCD+AB''CDE+AC''')')
20 disp('AB''CDE+AC''')//applying rules 8 and 7 to
   first and second terms, respectively ----->step
   1
21 disp('A(B''CDE+C''')')//taking A as common term
   ----->step 2
22 disp('A(B''DE+C''')')//by applying B''CDE+C'=B'DE+C

```



```

23      '----->step 3
      //=====END OF PROGRAM
      =====

```

---

**Scilab code Exa 15.17 LOGIC CIRCUIT SIMPLIFICATION**

```

1 //Chapter –15, Example 15.17, Page 513
2 //
      =====

3 clc
4 clear
5 //CALCULATIONS
6 disp('(((A+C'''))''(BD'''))''.'((A+C''').(BD'''))''')''')
      //----->step 1
7 disp('((A+C''')+(BD'''))''.'((A+C'''+(BD'''))''')''')//
      ----->step 2
8 disp('((A+C''')+(BD'''))''.'((A+C'''+(BD'''))''')''')//
      ----->step 3
9 disp('((BD'''))''+((A+C''')((A+C'''))''')''')//----->
      step 4
10 disp('BD''')''')''')//----->step 5
11 disp('BD''')//----->step 6
12 //=====END OF PROGRAM
      =====

```

---

**Scilab code Exa 15.19 SIMPLIFICATION OF K MAP**

```

1 //Chapter –15, Example 15.19, Page 519

```

```

2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 //The adjacent cells that can be combined together
   are the cells 000 and 100 and the cell 011 and
   111
7 //By combining the adjacent cells ,we get
8 disp('((A''+A)B''C'')+ (A''+A)BC') //----->step 1
9 disp('(B''C'')+ (BC)') //----->step 2
10 //=====END OF PROGRAM


---



```

**Scilab code Exa 15.20 SIMPLIFICATION OF K MAP**

```

1 //Chapter -15, Example 15.20, Page 519
2 //


---


3 clc
4 clear
5 //CALCULATIONS
6 disp('(B''C''D'')+ (BC''D)')
7 //=====END OF PROGRAM


---



```