

Scilab Manual for
POWER SYSTEM
by Prof Sita Singh
Electrical Engineering
Laxmi Institute Of Technology ¹

Solutions provided by
Prof Sita Singh
Electrical Engineering
Laxmi Institute Of Technology

May 11, 2025

¹Funded by a grant from the National Mission on Education through ICT, <http://spoken-tutorial.org/NMEICT-Intro>. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website <http://scilab.in>

Contents

List of Scilab Solutions	4
1 To Calculate the performance parameters for a short transmission line for a specific given quantities.	8
2 To Calculate the performance parameters for a medium T-network transmission line for a specific given quantities.	11
3 To Calculate the performance parameters for a medium pi-network transmission line for a specific given quantities.	15
4 To Calculate the performance parameters for a medium T-network transmission line using ABCD parameters.	18
5 To Calculate the performance parameters for a medium pi-network transmission line using ABCD parameters.	21
6 To Calculate the performance parameters for a Long transmission line using rigorous method solution.	24
7 To Calculate the performance parameters for a Long transmission line using ABCD parameters.	27
8 Short circuit study of a balanced three phase system.	30
9 Calculation of Symmetrical components of specified unbalanced system.	32
10 Calculation of fault current in Line to ground fault.	35

11 Calculation of fault current in Line to line to ground fault.	38
12 Calculation of fault current in Line to line fault.	41
13 Calculate variable load parameters on a power system.	44
14 Calculate cost of generation of a given specific power system.	47
15 Calculate Critical disruptive voltage for a given line.	50

List of Experiments

Solution 1.1	To Calculate the performance parameters for a short transmission line for a specific given quantities . .	8
Solution 2.2	To Calculate the performance parameters for a medium T network transmission line for a specific given quantities	11
Solution 3.3	To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities	15
Solution 4.4	To Calculate the performance parameters for a medium T network transmission line using ABCD parameters	18
Solution 5.5	To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters	21
Solution 6.6	To Calculate the performance parameters for a Long transmission line using rigorous method solution .	24
Solution 7.7	To Calculate the performance parameters for a Long transmission line using ABCD parameters	27
Solution 8.8	Short circuit study of a balanced three phase system	30
Solution 9.9	Calculation of Symmetrical components of specified unbalanced system	32
Solution 10.10	Calculation of fault current in Line to ground fault	35
Solution 11.11	Calculation of fault current in Line to line to ground fault	38
Solution 12.12	Calculation of fault current in Line to line fault .	41
Solution 13.13	Calculate variable load parameters on a power system	44

Solution 14.14	Calculate cost of generation of a given specific power system	47
Solution 15.15	Calculate Critical disruptive voltage for a given line	50

List of Figures

1.1	To Calculate the performance parameters for a short transmission line for a specific given quantities	9
2.1	To Calculate the performance parameters for a medium T network transmission line for a specific given quantities	12
3.1	To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities	16
4.1	To Calculate the performance parameters for a medium T network transmission line using ABCD parameters	19
5.1	To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters	22
6.1	To Calculate the performance parameters for a Long transmission line using rigorous method solution	25
7.1	To Calculate the performance parameters for a Long transmission line using ABCD parameters	28
8.1	Short circuit study of a balanced three phase system	31
9.1	Calculation of Symmetrical components of specified unbalanced system	33
10.1	Calculation of fault current in Line to ground fault	36
11.1	Calculation of fault current in Line to line to ground fault	38
12.1	Calculation of fault current in Line to line fault	41

13.1 Calculate variable load parameters on a power system	45
14.1 Calculate cost of generation of a given specific power system	48
15.1 Calculate Critical disruptive voltage for a given line	51

Experiment: 1

To Calculate the performance parameters for a short transmission line for a specific given quantities.

Scilab code Solution 1.1 To Calculate the performance parameters for a short transmission line for a specific given quantities

```
1 //To Calculate the performance parameters for a
   short transmission line for a specific given
   quantities.
2 // A single phase overhead transmission line
   delivers 1100kW at 33kV at 0.8 pf lagging.The
   total resistance and inductive reactance of the
   line are 10ohm and 15 ohm respectively. Determine
   i) Sending end voltage ii)Sending end power
   factor iii)efficiency
3 //Windows 10
4 //5.4.1
5 //
```

```
Scilab 5.5.2 Console

Enter the power supplied to the load:1100e3
Enter the receiving end voltage:33e3
Enter the power factor:0.8
Enter the loop resistance:10
Enter the loop reactance:15

The values of ABCD parameters respectively are

1.
10. + 15.i
0.
1.

regulation of the line is

2.1492739

efficiency of the line is

98.44624
```

Figure 1.1: To Calculate the performance parameters for a short transmission line for a specific given quantities

```
6  clc;
7  clear;
8  sup=input('Enter the power supplied to the load:');
9  vr=input('Enter the receiving end voltage:');
10 cosphi=input('Enter the power factor:');
11 sinphi=sin(acos(cosphi));
12 r=input('Enter the loop resistance:');
13 xl=input('Enter the loop reactance:');
14 z= r+%i*xl;
15 A=1;
16 B=z;
17 C=0;
18 D=A;
19 disp(D,C,B,A,'The values of ABCD parameters
    respectively are');
20 ir=(sup/(vr*cosphi));
21 irv=ir*(cosphi-%i*sinphi);
22 vsph=(A*vr+B*irv);
23 vsh=abs(vsph);
```

```
24 reg=((abs(vsh/A)-abs(vr))/vr)*100;
25 disp(reg,'regulation of the line is ');
26 loss=((abs(ir))^2*r);
27 output=sup+loss;
28 eff=(sup/output)*100;
29 disp(eff,'efficiency of the line is ');
```

Experiment: 2

To Calculate the performance parameters for a medium T-network transmission line for a specific given quantities.

Scilab code Solution 2.2 To Calculate the performance parameters for a medium T network transmission line for a specific given quantities

```
1 //To Calculate the performance parameters for a
   medium T-network transmission line for a specific
   given quantities
2 // Determine efficiency and regulation of 3 phase
   100km 50 hz, transmission line delivering 20 MW
   at a pf of 0.8 lagging and 66 kV to a balance
   load.The conductors are copper each having
   resistance 0.1 ohm per km, 1.5 cm outside dia ,
   spaced equilaterally 2 mts between centres.
   Neglect leakage and use Nominal T method. ( C L
   Wadhwa, Ch-4 ex.4.5)
3 //Windows 10
```

```

enter the value of recieving end voltage66e3
enter the supply power20e6
enter the power factor0.8

receiving end current magnitude

218.95253
enter the resistance10
enter the reactance35.1
enter the capcitive susceptance0.9954e-6

sending end current

210.82874

sending end voltage

44551.269

powerfactor sendingend

0.7606371

input power is

21433280.

efficiency is

93.312829

regulation of the line is

16.778328

```

Figure 2.1: To Calculate the performance parameters for a medium T network transmission line for a specific given quantities

```

4 // 5.5.2
5 clc;
6 clear;
7 vr=input('enter the value of recieving end voltage')
8 ;
9 vrph=vr/1.73;
10 p=input('enter the supply power');
11 pf=input('enter the power factor');
12 spf=sin(acos(pf));
13 ir=p/(1.73*vr*pf);
14 disp(ir,'receiving end current magnitude');
15 spf=sin(acos(pf));
16 r=input('enter the resistance');
17 xl=input('enter the reactance');
18 xc=input('enter the capcitive susceptance');
19 z=r+%i*xl;
20 imp2=z/2
21 ad=%i*(314*xc);
22 irv=ir*(pf-%i*spf);
23 v1=vrph+(irv*imp2);
24 ic=ad*v1;
25 is=ic+irv;
26 isa=abs(is);
27 disp(isa,'sending end current');
28 vs=v1+(is*(z/2));
29 vsh=abs(vs);
30 disp(vsh,'sending end voltage');
31 e=phasemag(vs);
32 f=phasemag(is);
33 os=e-f;
34 pfs=cosd(os);
35 disp(pfs,'powerfactor sendingend');
36 op=3*vsh*pfs*isa;
37 disp(op,'input power is');
38 eff=(p/op)*100;
39 disp(eff,'efficiency is');
40 reg=((vsh-vrph)/vrph)*100;
41 disp(reg,'regulation of the line is');

```


Experiment: 3

To Calculate the performance parameters for a medium pi-network transmission line for a specific given quantities.

Scilab code Solution 3.3 To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities

```
1 //Windows 10
2 // 5.5.2
3 //To Calculate the performance parameters for a
  medium pi- network transmission line for a
  specific given quantities.
4 // A 3 phase 50Hz, 150km line has a resistance ,
  inductive reactance and capacitive shunt
  admittance of 0.1,0.5, and 3e-6 S per km. If the
  line delivers 50MW at 110kV and 0.8 pf determine
  Volatge regulation & efficiency of line using pi
  method.
5 clc;
```



```
Enter the power supplied to the load:50e6
enter the receiving end volatge:110e3
Enter the power factor:0.8
Enter the resistance per phase0.1
Enter the inductive reactance per phase0.5
Enter the shunt admittance value:3e-6
Enter the length of line150
```

```
sending end voltage
```

```
82885.561
```

```
Sending end current is
```

```
306.38482
```

```
Regulation of the line is
```

```
30.510912
```

```
efficiency of the line is
```

```
91.57757
```

Figure 3.1: To Calculate the performance parameters for a medium pi network transmission line for a specific given quantities

```

6  clear;
7  pl=input('Enter the power supplied to the load:');
8  vr=input('enter the receiving end volatge:');
9  pf=input('Enter the power factor:');
10 spf=sin(acos(pf));
11 r=input('Enter the resistance per phase');
12 xl=input('Enter the inductive reactance per phase');
13 y=input('Enter the shunt admittance value:');
14 lg=input('Enter the length of line');
15 R=r*lg;
16 Xl=xl*lg;
17 Z=R+%i*Xl;
18 Y=y*lg;
19 Y1=Y/2;
20 vrph=vr/sqrt(3);
21 ir=pl/(sqrt(3)*vr*pf);
22 irv=ir*(pf-%i*spf);
23 ic1=vrph*Y1;
24 il=irv+%i*ic1;
25 ilz=il*Z;
26 vsph=vrph+(il*Z);
27 vsh=abs(vsph);
28 disp(vsh,'sending end voltage');
29 ic2=vsph*Y1;
30 Is=il+(%i*ic2);
31 Ish=abs(Is);
32 disp(Ish,'Sending end current is');
33 reg=((abs(vsh)-abs(vrph))/vrph)*100;
34 disp(reg,'Regulation of the line is');
35 e=phasemag(vsph);
36 f=phasemag(Is);
37 phis=e-f;
38 cosine=cosd(phis);
39 inppl=3*vsh*Ish*cosine;
40 eff=(pl/inppl)*100;
41 disp(eff,'efficiency of the line is');

```

Experiment: 4

To Calculate the performance parameters for a medium T-network transmission line using ABCD parameters.

Scilab code Solution 4.4 To Calculate the performance parameters for a medium T network transmission line using ABCD parameters

```
1 //To Calculate the performance parameters for a
   medium T-network transmission line using ABCD
   parameters.
2 // A 3phase 50Hz overhaed transmission line 100 km
   long has the following constants ; r=0.1 ohm/km/
   phase ;xl=0.2/km/phase;xc=0.04e-4 siemen.
   Determine i)Sending end voltage ii) sending end
   power factor iii) transmission efficiency when
   supplying a balnced load of 10000kW at 66kV, pf
   0.8 lagging using nominal T method.
3 //Windows 10
4 // 5.5.2
```

```

Enter the power supplied to the load:10000e3
enter the receiving end volatge:66e3
Enter rhe power factor:0.8
Enter the series impedance value of single conductor:10+%i*20
Enter the shunt admittance value:0.04e-4

The values of ABCD parameters respectively are

1.00002 + 0.00004i

9.9997 + 20.0004i

0.000004

1.00002 + 0.00004i

Regulation of the line is

5.7781376

efficiency of the line is

96.537204

```

Figure 4.1: To Calculate the performance parameters for a medium T network transmission line using ABCD parameters

```

5
6  clc;
7  clear;
8  pl=input('Enter the power supplied to the load:');
9  vr=input('enter the receiving end volatge:');
10 pf=input('Enter rhe power factor:');
11 spf=sin(acos(pf));
12 z=input('Enter the series impedance value of single
    conductor:');
13 r=real(z);
14 y=input('Enter the shunt admittance value:');
15 e=((z*y)/2);
16 a=(1+e);
17 b=z*(1+e/2);
18 c=y;
19 d=a;
20 disp(d,c,b,a,'The values of ABCD parameters
    respectively are');
21 vrph=vr/sqrt(3);
22 ir=pl/(sqrt(3)*vr*pf);
23 irv=ir*(pf-%i*spf);
24 vsph=(a*vrph+b*irv);
25 vsh=abs(vsph);
26 reg=((abs(vsh/a)-abs(vrph))/vrph)*100;
27 disp(reg,'Regulation of the line is');
28 loss= 3*(ir^2)*r;
29 inppl=pl+loss;
30 eff=(pl/inppl)*100;
31 disp(eff,'efficiency of the line is');

```

Experiment: 5

To Calculate the performance parameters for a medium pi-network transmission line using ABCD parameters.

Scilab code Solution 5.5 To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters

```
1 // A 100 km long line 3 phase 50 Hz transmisison
   line has following line constants r/phase/km =0.1
   ohm; xl/km/phase = 0.5 ohm; Sussceptance/phase/
   km =10e-6. If the line supplies load of 20MW at
   0.9 pf lagging at 66kV at the receving end,
   calculate by nominal pi method i) sending end
   power factor , ii)regulation iii) transmission
   efficiency
2 //Windows 10
3 // 5.5.2
4
5 clc;
```

```

Enter the power supplied to the load:20e6
enter the receiving end volatge:66e3
Enter rhe power factor:0.9
Enter the series impedance value of single conductor:10+%i*50
Enter the shunt admittance value:10e-4

```

The values of ABCD parameters respectively are

```
1.005 + 0.025i
```

```
10. + 50.i
```

```
0.0010025 + 0.0000125i
```

```
1.005 + 0.025i
```

The value of Vs is

```
45158.204
```

Regulation of the line is

```
17.883484
```

efficiency of the line is

```
94.635711
```

Figure 5.1: To Calculate the performance parameters for a medium pi network transmission line using ABCD parameters

```

6  clear;
7  pl=input('Enter the power supplied to the load:');
8  vr=input('enter the receiving end volatge:');
9  pf=input('Enter rhe power factor:');
10 spf=sin(acos(pf));
11 z=input('Enter the series impedance value of single
    conductor:');
12 r=real(z);
13 y=input('Enter the shunt admittance value:');
14 e=((z*y)/2);
15 a=(1+e);
16 b=z;
17 c=y*(1+e/2);
18 d=a;
19 disp(d,c,b,a,'The values of ABCD parameters
    respectively are');
20 vrph=vr/sqrt(3);
21 ir=pl/(sqrt(3)*vr*pf);
22 irv=ir*(pf-%i*spf);
23 vsph=(a*vrph+b*irv);
24 vsh=abs(vsph);
25 disp(abs(vsph),'The value of Vs is');
26 reg=((abs(vsh/a)-abs(vrph))/vrph)*100;
27 disp(reg,'Regulation of the line is');
28 loss= 3*(ir^2)*r;
29 inppl=pl+loss;
30 eff=(pl/inppl)*100;
31 disp(eff,'efficiency of the line is');

```

Experiment: 6

To Calculate the performance parameters for a Long transmission line using rigorous method solution.

Scilab code Solution 6.6 To Calculate the performance parameters for a Long transmission line using rigorous method solution

```
1 //Windows 10
2 // 5.5.2
3 //To Calculate the performance parameters for a Long
   transmission line using rigorous method solution
4 //Given r=0.2 per km,L=1.3mH per km, C=0.01
   microfarad ,power factor =0.8, length of line =120
   km, recivening end power=40MW,receiving end
   voltage =132kV.Calculate efficiency of line using
   rigorous solution.
5 clear;
6 clc;
```

$Z_C =$

$$370.65158 - 85.922023i$$

sending end voltage

$$86602.848 - 11007.334i$$

Sending end current

$$228.26796 + 23.218333i$$

$$60072683. - 1505543.8i$$

efficiency of line is

$$66.565103$$

Figure 6.1: To Calculate the performance parameters for a Long transmission line using rigorous method solution

```

7 R=0.2;
8 L=1.3e-3;
9 C=0.01e-6;
10 z=R+%i*L*314;
11 y=%i*314*C;
12 cimp=(z/y);
13 Zc=sqrt(cimp);
14 disp(Zc, 'Zc=');
15 adm=y*z;
16 Y=sqrt(adm);
17 Yl=Y*120;
18 alpha=real(Yl);
19 Beta=imag(Yl);
20 Vr=(132*1000)/sqrt(3);
21 Ir=(40*1000)/(sqrt(3)*(132*0.8));
22 Irv=Ir*(0.8-%i*0.6);
23 Vsp=((Vr+Irv*Zc)/2)*exp(alpha)*exp(Beta);
24 Vsn=((Vr-Irv*Zc)/2)*exp(-alpha)*exp(-Beta);
25 Vs=Vsp+Vsn;
26 disp(Vs, 'sending end voltage');
27 Is=(Vsp/Zc)+(Vsn/Zc);
28 disp(Is, 'Sending end current');
29 spl=3*Vs*Is
30 disp(spl);
31 splm=abs(spl);
32 eff=(40*1000000/splm)*100;
33 disp(eff, 'efficiency of line is');

```

Experiment: 7

To Calculate the performance parameters for a Long transmission line using ABCD parameters.

Scilab code Solution 7.7 To Calculate the performance parameters for a Long transmission line using ABCD parameters

```
1 //Windows 10
2 // 5.5.2
3 //To Calculate the performance parameters for a Long
  transmission line using ABCD parameters.
4 //Given r=0.2 per km,L=1.3mH per km, C=0.01
  microfarad,power factor =0.8, length of line =120
  km, recivening end power=40MW,receiving end
  voltage =132kV.Calculate efficiency of using ABCD
  parameters calcuation.
5 clear;
6 clc;
7 R=0.2;
```

The values of ABCD parameters respectively are

$$0.9990772 + 0.0004520i$$

$$23.985236 + 48.972549i$$

$$- 5.678D-09 + 0.0000377i$$

$$0.9990772 + 0.0004520i$$

the value of sending end voltage is

$$86.762221 + 5.4551767i$$

the value of sending end current is

$$174.85207 - 128.14509i$$

Regulation of the line is

$$14.176127$$

efficiency of the line is

$$70.750291$$

Figure 7.1: To Calculate the performance parameters for a Long transmission line using ABCD parameters

```

8 L=1.3e-3;
9 C=0.001e-6;
10 z=R+%i*L*314;
11 y=%i*314*C;
12 cimp=(z/y);
13 Zc=sqrt(cimp);
14 adm=y*z;
15 Y=sqrt(adm);
16 lg=120;
17 Vr=(132)/sqrt(3);
18 Ir=(40*1000)/(sqrt(3)*132*0.8);
19 cosine=cosh(Y*lg);
20 sine=sinh(Y*lg);
21 a=cosine;
22 b=Zc*sine;
23 c=((1/Zc)*sine);
24 d=a;
25 disp(d,c,b,a,'The values of ABCD parameters
    respectively are');
26 irv=Ir*(0.8-%i*0.6);
27 irvinKA=irv*10^-3;
28 vs=((a*Vr)+(b*irvinKA));
29 disp(vs,'the value of sending end voltage is');
30 vsh=abs(vs);
31 is=c*Vr*1000+d*irv;
32 disp(is,'the value of sending end current is');
33 pis=polar(is);
34 reg=((vsh/a)-abs(Vr))/Vr*100;
35 mreg=abs(reg);
36 disp(mreg,'Regulation of the line is');
37 spl=3*vsh*is;
38 splab=abs(spl);
39 eff=(40*1000/splab)*100;
40 disp(eff,'efficiency of the line is');

```

Experiment: 8

Short circuit study of a balanced three phase system.

Scilab code Solution 8.8 Short circuit study of a balanced three phase system

```
1 //Short circuit study of a balanced three phase
   system
2 //Windows 10
3 // 5.5.2
4 // A station operating at 33 kV is divided into
   sections A and B. Section A consists of three
   generators 15 MVA each having a reactance of 15%
   and section B is fed from the grid through a 75
   MVA transformer of 8% reactance. The circuit
   breakers have each a rupturing capacity of 750
   MVA. Determine the reactance of the reactor to
   prevent the breakers being overloaded if a
   symmetrical short circuit occurs on an outgoing
   feeder connected to A.
5
6 clear;
```

```

The base MVA of the system is75
The base kV of the system is33
The pu reactance of generator on its base is0.15
The base of generator original is15
The pu reactance of transformer on its base is0.08

The value of reactor in pu is

0.0870536

The actual value of reactance of the reactor in pu is

1.2640179

```

Figure 8.1: Short circuit study of a balanced three phase system

```

7  clc;
8  Sb=input('The base MVA of the system is');
9  bkv=input('The base kV of the system is');
10 greac=input('The pu reactance of generator on its
    base is');
11 bgen=input('The base of generator original is');
12 treac=input('The pu reactance of transformer on its
    base is');
13 Xpu=(greac*Sb)/bgen;
14 //The calculated value of X
15 X=9.75/112;
16 disp(X,'The value of reactor in pu is');
17 Xa=(X*(bkv^2))/Sb;
18 disp(Xa,'The actual value of reactance of the
    reactor in pu is');

```

Experiment: 9

Calculation of Symmetrical components of specified unbalanced system.

Scilab code Solution 9.9 Calculation of Symmetrical components of specified unbalanced system

```
1 //Windows 10
2 // 5.5.2
3 //Calculation of Symmetrical components of specified
  unbalanced system.
4 //In a 3 phase 4 wire system the currents inR, Y and
  B lines are under abnormal condition of loading
  are as under: Ir=86.6+50j, Iy=25-43.3j, Ib=-30.
  Calculate positive negative and zero sequence
  currents in R line and return current in the
  neuatral wire.
5
6 clear;
7 clc;
8 Ir=input('enter the value of Ir');
```

```

enter the value of Ir86.6+%i*50
enter the value of Iy25-%i*43.3
enter the value of Ib-30+%i*0

The Input values in RYB are

86.6 + 50.i
25. - 43.3i
- 30.

1.      1.      1.
1. - 0.5 + 0.866i      - 0.499956 - 0.866i
1. - 0.499956 - 0.866i - 0.5 + 0.866i

0.3333236 - 5.551D-17i      0.3333382 + 5.551D-17i      0.3333382
0.3333382 + 5.551D-17i      - 0.1666764 - 0.2886836i      - 0.1666618 + 0.2886836i
0.3333382      - 0.1666618 + 0.2886836i      - 0.1666764 - 0.2886836i

Values of symmetrical components of current are

27.199129 + 2.2326327i
17.200032 + 8.006403i
42.200839 + 39.760964i

Value of current in the neutral wire

81.6 + 6.7i

```

Figure 9.1: Calculation of Symmetrical components of specified unbalanced system

```

 9 Iy=input('enter the value of Iy');
10 Ib=input('enter the value of Ib');
11 a=-0.5+0.866*%i;
12 Iryb=[Ir;Iy;Ib];
13 disp(Iryb,'The Input values in RYB are');
14 A=[1 1 1;1 a a^2;1 a^2 a];
15 disp(A);
16 ainv=inv(A);
17 disp(ainv);
18 IA012=inv(A)*Iryb;
19 disp(IA012,'Values of symmetrical components of
    current are');
20 In=Ir+Iy+Ib;
21 disp(In,'Value of current in the neutral wire');

```

Experiment: 10

Calculation of fault current in Line to ground fault.

Scilab code Solution 10.10 Calculation of fault current in Line to ground fault

```
1  ///Windows 10
2  // 5.5.2
3  //Calculation of fault current in Line to ground
   fault .
4  //A 30 MVA, 13.8 kV, 3-phase alternator has a
   subtransient reactance of 15% and negative and
   zero sequence reactances of 15% and 5%
   respectively. The alternator supplies two motors
   over a transmission line having transformers at
   both ends as shown on the one-line diagram. The
   motors have rated inputs of 20 MVA and 10 MVA
   both 12.5 kV with 20% subtransient reactance and
   negative and zero sequence reactances are 20% and
   5% respectively. Current limiting reactors of
   2.0 ohms each are in the neutral of the
   alternator and the larger motor. The 3-phase
```

```

Enter the positive sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positive sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positive sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positive sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

equivalent value of P,N,Z of system is

0.6378
0.6378
1.6773996

The fault current in amperes is

1275.1232

```

Figure 10.1: Calculation of fault current in Line to ground fault

transformers are both rated 35 MVA, 13.2 kV with leakage reactance of 10%. Series reactance of the line is 80 ohms. The zero sequence reactance of the line is 200 ohms. Determine the fault current when (i) L-G (ii) L-L, and (iii) L-L-G fault takes place at point P. Assume $V_f = 120$ kV.//

```

5  clc ;
6  clear;
7  G=input('Enter the positive sequence , negative
           sequence and zero sequence of the generator in
           matrix form');
8  PG=G(:,1);
9  NG=G(:,2);
10 ZG=G(:,3);
11 M1=input('Enter the positive sequence , negative
            sequence and zero sequence of the Motor 1 in
            matrix form');
12 PM1=M1(:,1);
13 NM1=M1(:,2);
14 ZM1=M1(:,3);
15 M2=input('Enter the positive sequence , negative
            sequence and zero sequence of the Motor 2 in
            matrix form');
16 PM2=M2(:,1);

```

```

17 NM2=M2(:,2);
18 ZM2=M2(:,3);
19 T1=input('Enter the positive sequence , negative
           sequence and zero sequence of the transformer 1
           in matrix form');
20 PT1=T1(:,1);
21 NT1=T1(:,2);
22 ZT1=T1(:,3);
23 T2=input('Enter the positive sequence , negative
           sequence and zero sequence of the transformer 2
           in matrix form');
24 PT2=T2(:,1);
25 NT2=T2(:,2);
26 ZT2=T2(:,3);
27 L=input('Enter the positive sequence , negative
           sequence and zero sequence of the transmission
           line in matrix form');
28 PL=L(:,1);
29 NL=L(:,2);
30 ZL=L(:,3);
31 KVAB=input('Enter the value of base KVA');
32 KVB=input('Enter the value of base KV');
33 IB=KVAB/(KVB*1.732);
34 P=PG+PT1+PL+PT2+((PM1*PM2)/(PM1+PM2));
35 N=NG+NT1+NL+NT2+((NM1*NM2)/(NM1+NM2));
36 Z=ZG+ZT1+ZL+ZT2+((ZM1*ZM2)/(ZM1+ZM2));
37 disp(Z,N,P,'equivalent value of P,N,Z of system is')
   ;
38 IF=3/(P+N+Z);
39 FAULTCURRENT=IF*IB;
40 disp(FAULTCURRENT,'The fault current in amperes is')
   );

```

Experiment: 11

Calculation of fault current in Line to line to ground fault.

Scilab code Solution 11.11 Calculation of fault current in Line to line to ground fault

```
1  ///Windows 10
2  // 5.5.2
3  // Calculation of fault current in Line to line fault
```

```
Enter the positive sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positive sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positive sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positive sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

equivalent value of P,N,Z of system is

0.6378
0.6378
1.6773996

The fault current is

- 1944.1406
```

Figure 11.1: Calculation of fault current in Line to line to ground fault

```

4 //A 30 MVA, 13.8 kV, 3-phase alternator has a
   subtransient reactance of 15% and negative and
   zero sequence reactances of 15% and 5%
   respectively. The alternator supplies two motors
   over a transmission line having transformers at
   both ends as shown on the one-line diagram. The
   motors have rated inputs of 20 MVA and 10 MVA
   both 12.5 kV with 20% subtransient reactance and
   negative and zero sequence reactances are 20% and
   5% respectively. Current limiting reactors of
   2.0 ohms each are in the neutral of the
   alternator and the larger motor. The 3-phase
   transformers are both rated 35 MVA, 13.2 kV -115Y
   kV with leakage reactance of 10%. Series
   reactance of the line is 80 ohms. The zero
   sequence reactance of the line is 200 ohms.
   Determine the fault current when (i) L-G (ii) L-L
   , and (iii) L-L-G fault takes place at point P.
   Assume  $V_f = 120$  kV.//
5 clc ;
6 clear;
7 G=input('Enter the positive sequence , negative
   sequence and zero sequence of the generator in
   matrix form');
8 PG=G(:,1);
9 NG=G(:,2);
10 ZG=G(:,3);
11 M1=input('Enter the positive sequence , negative
   sequence and zero sequence of the Motor 1 in
   matrix form');
12 PM1=M1(:,1);
13 NM1=M1(:,2);
14 ZM1=M1(:,3);
15 M2=input('Enter the positive sequence , negative
   sequence and zero sequence of the Motor 2 in
   matrix form');
16 PM2=M2(:,1);

```



```

17 NM2=M2(:,2);
18 ZM2=M2(:,3);
19 T1=input('Enter the positive sequence , negative
           sequence and zero sequence of the transformer 1
           in matrix form');
20 PT1=T1(:,1);
21 NT1=T1(:,2);
22 ZT1=T1(:,3);
23 T2=input('Enter the positive sequence , negative
           sequence and zero sequence of the transformer 2
           in matrix form');
24 PT2=T2(:,1);
25 NT2=T2(:,2);
26 ZT2=T2(:,3);
27 L=input('Enter the positive sequence , negative
           sequence and zero sequence of the transmission
           line in matrix form');
28 PL=L(:,1);
29 NL=L(:,2);
30 ZL=L(:,3);
31 KVAB=input('Enter the value of base KVA');
32 KVB=input('Enter the value of base KV');
33 IB=KVAB/(KVB*1.732);
34 P=(PG+PT1+PL+PT2)+((PM1*PM2)/(PM1+PM2));
35 N=(NG+NT1+NL+NT2)+((NM1*NM2)/(NM1+NM2));
36 Z=(ZG+ZT1+ZL+ZT2)+((ZM1*ZM2)/(ZM1+ZM2));
37 disp(Z,N,P,'equivalent value of P,N,Z of system is ');
   ;
38 fz=(Z*N)/(Z+N);
39 I1=(1)/(P+fz);
40 I2=(-I1*Z)/(N*Z);
41 I0=I1+I2
42 IF=3*I0;
43 FAULTCURRENT=IF*IB;
44 disp(FAULTCURRENT,'The fault current is ');

```

Experiment: 12

Calculation of fault current in Line to line fault.

Scilab code Solution 12.12 Calculation of fault current in Line to line fault

```
1  ///Windows 10
2  // 5.5.2
3  //Calculation of fault current in Line to line fault
```

```
Enter the positive sequence , negative sequence and zero sequence of the generator in matrix form[0.15 0.15 0.995]
Enter the positive sequence , negative sequence and zero sequence of the Motor 1 in matrix form[0.492 0.492 1.006]
Enter the positive sequence , negative sequence and zero sequence of the Motor 2 in matrix form[0.246 0.246 0.123]
Enter the positive sequence , negative sequence and zero sequence of the transformer 1 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transformer 2 in matrix form[0.0784 0.0784 0.0784]
Enter the positive sequence , negative sequence and zero sequence of the transmission line in matrix form[0.167 0.167 0.416]
Enter the value of base KVA30000
Enter the value of base KV13.8

equivalent value of P,N,Z of system is

    0.6378

    0.6378

    1.6773996

The fault current is

- 1704.2278
```

Figure 12.1: Calculation of fault current in Line to line fault

```

4 //A 30 MVA, 13.8 kV, 3-phase alternator has a
    subtransient reactance of 15% and negative and
    zero sequence reactances of 15% and 5%
    respectively. The alternator supplies two motors
    over a transmission line having transformers at
    both ends as shown on the one-line diagram. The
    motors have rated inputs of 20 MVA and 10 MVA
    both 12.5 kV with 20% subtransient reactance and
    negative and zero sequence reactances are 20% and
    5% respectively. Current limiting reactors of
    2.0 ohms each are in the neutral of the
    alternator and the larger motor. The 3-phase
    transformers are both rated 35 MVA, 13.2 kV -115Y
    kV with leakage reactance of 10%. Series
    reactance of the line is 80 ohms. The zero
    sequence reactance of the line is 200 ohms.
    Determine the fault current when (i) L-G (ii) L-L
    , and (iii) L-L-G fault takes place at point P.
    Assume  $V_f = 120$  kV.//
5 clc ;
6 clear;
7 G=input('Enter the positive sequence , negative
    sequence and zero sequence of the generator in
    matrix form');
8 PG=G(:,1);
9 NG=G(:,2);
10 ZG=G(:,3);
11 M1=input('Enter the positive sequence , negative
    sequence and zero sequence of the Motor 1 in
    matrix form');
12 PM1=M1(:,1);
13 NM1=M1(:,2);
14 ZM1=M1(:,3);
15 M2=input('Enter the positive sequence , negative
    sequence and zero sequence of the Motor 2 in
    matrix form');
16 PM2=M2(:,1);

```

```

17 NM2=M2(:,2);
18 ZM2=M2(:,3);
19 T1=input('Enter the positive sequence , negative
sequence and zero sequence of the transformer 1
in matrix form');
20 PT1=T1(:,1);
21 NT1=T1(:,2);
22 ZT1=T1(:,3);
23 T2=input('Enter the positive sequence , negative
sequence and zero sequence of the transformer 2
in matrix form');
24 PT2=T2(:,1);
25 NT2=T2(:,2);
26 ZT2=T2(:,3);
27 L=input('Enter the positive sequence , negative
sequence and zero sequence of the transmission
line in matrix form');
28 PL=L(:,1);
29 NL=L(:,2);
30 ZL=L(:,3);
31 KVAB=input('Enter the value of base KVA');
32 KVB=input('Enter the value of base KV');
33 IB=KVAB/(KVB*1.732);
34 P=(PG+PT1+PL+PT2)+((PM1*PM2)/(PM1+PM2));
35 N=(NG+NT1+NL+NT2)+((NM1*NM2)/(NM1+NM2));
36 Z=(ZG+ZT1+ZL+ZT2)+((ZM1*ZM2)/(ZM1+ZM2));
37 disp(Z,N,P,'equivalent value of P,N,Z of system is')
;
38 IF=(-1.732)/(P+N)
39 FAULTCURRENT=IF*IB;
40 disp(FAULTCURRENT,'The fault current is');

```

Experiment: 13

Calculate variable load parameters on a power system.

Scilab code Solution 13.13 Calculate variable load parameters on a power system

```
1 // Calculate variable load parameters on a power
   system.
2 // Windows 10
3 // 5.5.2
4 // A generating station has a connected load of 43
   MW and a maximum demand of 20 MW, units generated
   per annum being 61.5e6. Calculate i) Demand
   factor ii) Load factor( V K Mehta, Ex. 3.2)
5 clc;
6 clear;
7 cl=input('Enter the connected load');
8 md=input('Enter the maximum demand');
9 ug=input('Enter the units generated per annum');
10 df=md/cl;
11 disp(df,'The demand factor of the system is');
12 ad=ug/8760;
```

```
Enter the connected load43e6
Enter the maximum demand20e6
Enter the units generated per annum61.5e6

The demand factor of the system is

0.4651163

The average demand of the system in kwis

7020.5479

The load factor of the system is

35.10274
```

Figure 13.1: Calculate variable load parameters on a power system

```
13 disp(ad,'The average demand of the system in kwis')
    ;
14 lf=(ad*1000/md)*100;
15 disp(lf,'The load factor of the system is');
```

Experiment: 14

Calculate cost of generation of a given specific power system.

Scilab code Solution 14.14 Calculate cost of generation of a given specific power system

```
1 // Calculate cost of generation of a given specific
   power system.
2 //Windows 10
3 // 5.5.2
4 // A generating station has a maximum demand of
   50,000kW. Calculate the cost of generation from
   the following data: Capital cost=Rs. 95e6, annual
   load factor=40%, annual cost of fuel and oil =
   Rs 9e6; Taxes wages and salaries=Rs. 7.5e6;
   Interest and depreciation = 12%.
5 clc;
6 clear;
7 md=input('Enter the maximum demand on the generating
   station ');
8 cc=input('Enter the capital cost of the generating
   station ');
```



```
Enter the maximum demand on the generating station50000e3
Enter the capital cost of the generating station95e6
Enter the annual load factor0.4
Enter the annual cost of fuel & oil9e6
Enter the taxes, wages salaries7.5e6
Enter the Intrest and depriciation0.12
```

The units generated per annum is

1.752D+11

Annual fixed cost is

11400000.

Annual running charges

16500000.

Total Annual charges

27900000.

Cost per unit is

0.1592466

Figure 14.1: Calculate cost of generation of a given specific power system

```
9  alf=input('Enter the annual load factor');
10 acfl=input('Enter the annual cost of fuel & oil');
11 tws=input('Enter the taxes, wages salaries');
12 id=input('Enter the Intrest and depriciation');
13 ugperannuam=(md*alf*8760);
14 disp(ugperannuam,'The units generated per annum is')
    ;
15 afc=(id*cc);
16 disp(afc,'Annual fixed cost is');
17 arc=acfl+tws;
18 disp(arc,'Annual running charges');
19 tac=afc+arc;
20 disp(tac,'Total Annual charges');
21 gencost=(tac*1000)/ugperannuam;
22 disp(gencost,'Cost per unit is');
```

Experiment: 15

Calculate Critical disruptive voltage for a given line.

Scilab code Solution 15.15 Calculate Critical disruptive voltage for a given line

```
1 // Calculate Critical disruptive voltage for a given
   line.
2 // Windows 10
3 // 5.5.2
4 // Calculate the critical disruptive voltage &
   corona power loss for a conductor of dia 1.5 cm
   and the separation between conductors is 3.
   Breakdown strength is 21.1 kv/cm, Air density
   correction factor is given 1.05.
5 clear;
6 clc;
7 D=input('Enter the diameter:');
8 g0=input('Enter the breakdown strength:');
9 del=input('Enter the air density factor:');
10 d=input('Enter the separation between two conductor:
   ');
```

```

Enter the diameter:1.5
Enter the breakdown strength:21.1
Enter the air density factor:1.05
Enter the seperation between two conductor:300
Enter the irregularity factor:1

critical distruptive voltage:

99.555673
Enter the line voltage:220
Enter the frequency :50

corona loss:

6.5622594

```

Figure 15.1: Calculate Critical disruptive voltage for a given line

```

11 m0=input('Enter the irregularity factor:');
12 r=D/2;
13 x=d/r;
14 y=log(x);
15 V0=r*g0*del*m0*y;
16 disp(V0,'critical distruptive voltage:');
17 //to find corona loss
18 V1=input('Enter the line voltage:');
19 Vp=V1/1.73;
20 f=input(' Enter the frequency :');
21 z=sqrt(1/x);
22 P=241*10^-5*(f+25)/del*z*(Vp-V0)^2;
23 disp(P,'corona loss:');

```
