Scilab Manual for
Optical Communication
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Experiment: 1

To calculate the numerical aperture of the optical fiber.

Scilab code Solution 1.1 Numerical aperture

```
1  //Experiment no.1 To calculate the numerical
       aperture of the optical fiber.
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //n1=1.50
6  //n2=1.47
7  clear;
8  close;
9  clc;
10 n1=input("enter the value of core refractive index")
11 n2=input("enter the value of cladding refractive
       index")
12 delta=(n1^2-n2^2)/(2*n1^2)
13 NA=n1*sqrt(2*delta)
14 accept=asind(NA)
15 disp (NA,"numerical aperture=");
```
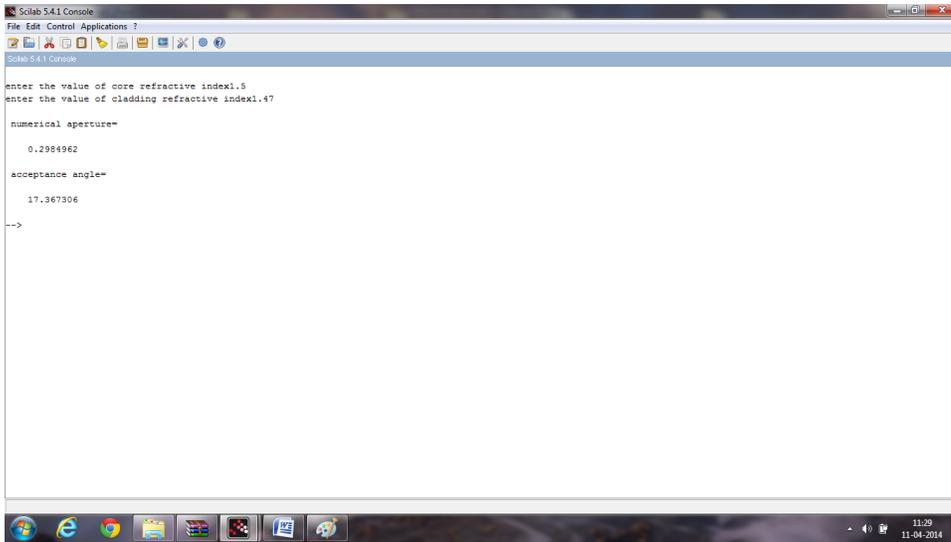
Figure 1.1: Numerical aperture

```
16  disp (accept,"acceptance angle=");
```

Experiment: 2

To calculate the Bending Loss in the optical fiber in the link.

Scilab code Solution 2.2 Bending Loss

```
1  //Experiment no.2 To calculate the Bending Loss in
      the optical fiber in the link.
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //n1=1.50
6  //n2=1.47
7  //R=1e-2
8  //lambda=0.82
9  clear;
10 close;
11 clc;
12 n1=input("enter the value of core refractive index="
      )
13 n2=input("enter the value of cladding refractive
      index=")
14 R=input("enter the value of radius of curvature of
```

Figure 2.1: Bending Loss

```
      bend in m=")//curvature of bend
15  lambda=input("enter the value wavelength in
      micrometer=")
16  c1=1.2;//constant
17  c2=0.5//constant
18  delta=(n1^2-n2^2)/(2*n1^2);
19  Rc=(3*lambda*1e-6)/(4*3.14*2*delta);
20  alpha=c1*exp(-c2*R);
21  alphadb=10*log(alpha)
22  disp (alphadb,"Bending loss in db=");
23  disp (Rc,"critical radius in m=");
```
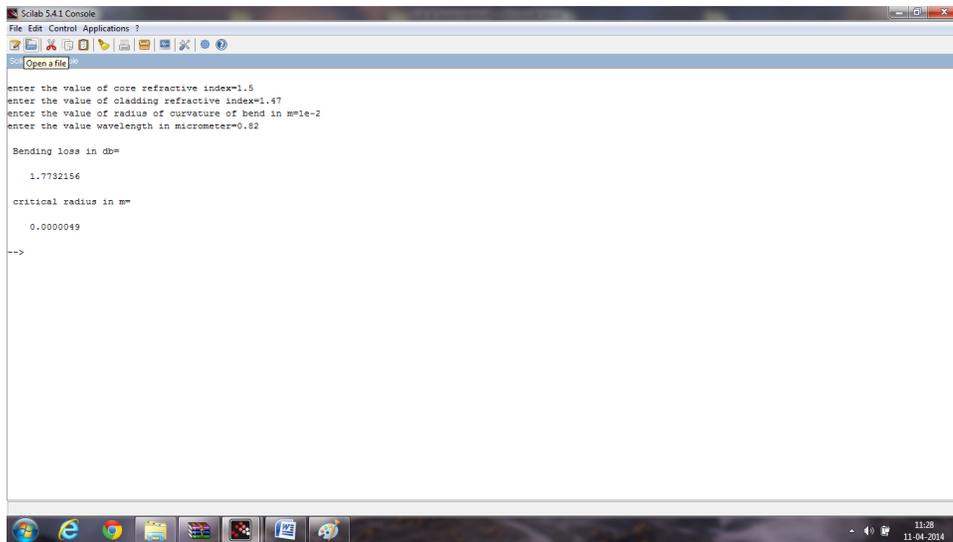
Experiment: 3

To plot the responsivity curve for the given detector material.

Scilab code Solution 3.3 Responsivity

```
1  //Experiment no.3 To plot the responsivity curve for
       the given detector material.
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //Eg=1.43
6  clear;
7  close;
8  clc;
9  Eg=input("Band gap of material selected in eV=")
10 e=1.6e-19;
11 eta=0.65//quantum efficiency
12 h=6.626e-34;//planks constant
13 c=3e8//velocity of light
14 lambdacf=h*c/(Eg*e*1e-6);//wavelength in micrometer
15 lambda=0:0.25:2//range of wavelength
16 for i=1:9
```
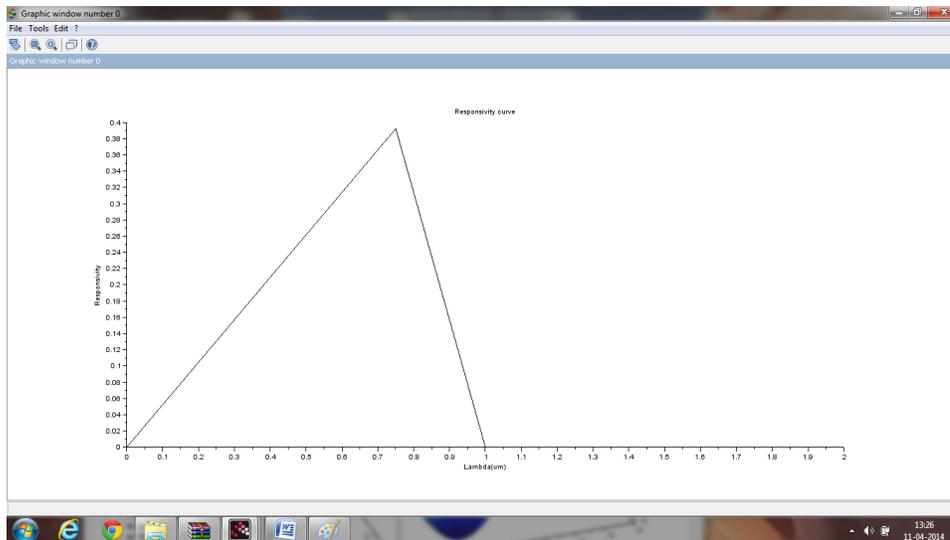
Figure 3.1: Responsivity

```
17        if(lambda(i)<lambdacf)
18        responsivity(i)=eta*e*1e-6*lambda(i)/(h*c);
19  else  responsivity(i)=0
20        end
21  end
22  plot2d(lambda,responsivity);
23  xtitle('Responsivity curve', 'Lambda(um)', '
        Responsivity');
```

Experiment: 4

To plot the characteristic curve for LED.

Scilab code Solution 4.4 LEDcharacteristics

```
1 //Experiment no.4 To plot the characteristic curve
    for LED. .
2 //OS=Windows XP sp3
3 //Scilab version 5.4.0
4 clear;
5 close;
6 clc;
7 h=6.626e-34;//planks constant
8 c=3e8;//velocity of light
9 e=1.6e-19;//charge of electron
10 lambda=0.87e-6//wavelength of light
11 tr=60e-9;//regenerative recombination
12 tnr=100e-9;//non regenerative recombination
13 t=tr*tnr/(tr+tnr);
14 Nint=t/tnr//internal quantum efficiency
15 for i= 1:40
16     L(i)=i;
```

```
17        pint(i)=Nint*i*h*c*1e-3/(e*lambda);//i is
              current in amperes
18 end
19
20 plot2d(L,pint);
21 xtitle('Characteristics of LED', 'Current(Amperes)',
       'Power(Watts)');
```

Experiment: 5

To calculate material dispersion at various wavelength of operation.

Scilab code Solution 5.5 Material dispersion

```
1  //Experiment no.5 To calculate material dispersion
       at various wavelength of operation.
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //L0=1.3 (zero dispersion wavelength psnm-2km-1)
6  //S0=0.095(Slope at zero dispersion wavelength in
       psnm-1km-1)
7
8  clear;
9  close;
10 clc;
11 L0=input("enter the value of zero dispersion
       wavelength in um")
12 S0=input("enter the value of Slope at zero
```

```
      dispersion wavelength")
13  lambda=0.7:0.1:1.7//wavelength of light
14  MD=(lambda.*S0/4).*(1-(L0./lambda).^4);//Material
      Dispersion
15  plot2d(lambda,MD);
16  xtitle('Material Dispersion at various wavelength',
      'wavelength(meters)', 'Material Dispersion(psnm−1
      km−1)');
```

Experiment: 6

To do power budgeting for the link for given parameters.

Scilab code Solution 6.6 Power Budgeting

```
1  //Experiment no.6 To do power budgeting for the link
       for given parameters
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //Ps=13 (input power in dBm)
6  //Pr=-31(sensitivity of receiver)
7  //L=80(Link length in Km)
8  //Loss=0.35(fiber loss in dB/Km)
9  //SL=0.1(Splice Lossin dB)
10 //CL=0.5(coupling loss in dB)
11 //EL=1.5(excess loss)
12
13 clear;
14 close;
15 clc;
16 Ps=input("Power from source in dBm=");
```

```
17  Pr=input(" sensitivity of receiver in dBm=");
18  L=input(" Link length in Km=");
19  Loss=input(" fiber loss in dB/Km=");
20  SL=input(" Splice Lossin dB/Km=");
21  CL=input(" coupling loss in dB=");
22  EL=input(" excess loss in dB=");
23  Pt=Ps-Pr;
24  SM=Pt-(2*CL+Loss*L+SL*L)
25  disp ("dB",SM," system margin=");
```

Experiment: 7

To do time budgeting for the link for given parameters.

Scilab code Solution 7.7 Time Budgeting

```
1  //Experiment no.7 To do rise time budgeting for the
      link for given parameters
2  //OS=Windows XP sp3
3  //Scilab version 5.4.0
4  //sample values
5  //ts=10 (rise time of the led source in ns)
6  //IMD=6(intermodal dispersion in ns/Km)
7  //L=10(link length in Km)
8  //PB=2(pulse broadening in ns/Km)
9  //td=8(response time of detector in ns)
10 //F=1(1-RZ return to zero format, 2-NRZ-non return
      to zero format)
11
12
13 clear;
14 close;
15 clc;
```

```
16  ts=input (" rise  time  of  the  led  source  in  ns=");
17  IMD=input (" intermodal  dispersion  in  ns/Km=");
18  L=input (" Link  length  in  Km=");
19  PB=input (" pulse  broadening  in  ns/Km=");
20  td=input (" response  time  of  detector  in  ns=");
21  disp  (" Directory                         1-RZ  return  to  zero
          format ,  2-NRZ-non  return  to  zero  format");
22  F=input (" Format=");
23  Tsys=1.1*sqrt(ts^2+(L*IMD)^2+td^2+(L*PB)^2);
24  if  F==1  then  Bt=0.35*1e3/Tsys  //since  Tsys  is  in
          nano  sec  and  Bt  is  expressed  in  Mbps)
25        else  Bt=0.7*1e3/Tsys
26  end
27  disp  (" Mbps",Bt,"Maximum  bit  rate  for  the  link  =");
```

Experiment: 8

To calculate fiber parameters (dimensions, refractive index difference) for single mode operation.

Scilab code Solution 8.8 Single Mode

```
1 //Experiment no.8  To calculate fiber parameters for
        single mode operation
2 //OS=Windows XP sp3
3 //Scilab version 5.4.0
4 //sample values
5 //lambda(1)=8e-6 (wavelength of transmission)
6 //ric=1.45(refractive index of core)
7 //V=2.405(V mumber)
8 //delta=0.003(refractive index difference)
9
10
11 clear;
12 close;
```

```
13  clc;
14  lambda=0.8e-6:0.1e-6:1.7e-6;
15  ric=input("refractive index of core=");
16  V=input("V mumber for singlr mode transmission=");
17  delta=input("refractive index difference=");
18  for i=1:10
19      a(i)=V*lambda(i)/(2*3.14*ric*sqrt(2*delta))
20  end
21  plot2d(lambda,a);
22  xtitle('Core daimeter versus wavelength of
          transmission', 'Wavelength (Lambda)(m)', 'Core
          diameter(m)');
```