Scilab Textbook Companion for Modern Electronics Communication by J. S. Beasley and G. Miller[1]

Created by
Shruthi Murugan Thevar
electronics and telecommunication
Electrical Engineering
Anjuman-e-Islam's Kalsekar Technical Campus
College Teacher
Prof. Chaya.s
Cross-Checked by
Prof. Ramjan Khatik

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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.

Contents

List of Scilab Codes

Chapter 1

Introductory topics

Scilab code Exa 1.1 example1

```
//Introductory Topics :example 1-1 : (pg no. 8)
P1=0.001;
dB=10*log(0.001/0.001);
x=10^0;
y=x*P1*600;
V=sqrt(y);
printf("\ndB =10log(P1/P2) = 10log(1mW/1mW) = %.f dBm",dB);
//0 dBm indicates result was obtained to a 1-mW reference
// voltage measured across 600 ohm load for 0dBm level is 0.775 V
printf("\ndB =10log(P1/P2) \nwhere P2=V2^2/600 \nP1=0.001 W");
printf("\n0 dBm = 10log((V2^2)/600))/0.001");
printf("\nV2 =%.5f V",V);
//value of V2 is used to calculate the dBm(600) value
printf("\ndBm(600)=20log(V2/0.775)");
```

Scilab code Exa 1.2 example2

```
//Introductory Topics :example 1-2 : (pg no. 9 & 10)
P=0.001;
R=75;
R1=50;
x=(8/20);
y=(10^x);
V2=(y*0.775);
V=sqrt(P*R);
V1=sqrt(P*R1);
//It is a 600 ohm system so 0.775 V reference is
   used
printf("\ndBm(600)= 20log(V2/0.775)");
printf("\nV2 = %.3f V",V2);
//voltage reference for 75-ohm system
printf("\nV=sqrt(P*R) = %.3f V",V);
printf("\ndBm(75)= 20log(V/0.274)");
//voltage reference for 50-Ohm system
printf("\nV=sqrt(P*R) = %.4f V",V1);
printf("\ndB(50)= 20log(V/0.2236)");
```

Scilab code Exa 1.3 example3

```
//Introductory Topics :example 1-3 : (pg no. 10)
x=(10/10);
y=(10^x);
P2=(y*0.001);
a=(log10(0.01/1));
z=(10*a);
//Converting +10dBm to Watts
printf("\n+10dBm =10log(P2/0/001)");
```

```
printf("\nP2 =%.2f W",P2);
//Converting +10dBm to dBW
printf("\ndBW = 10log(0.01W/1W)");
printf("\ndBW = %.f dBW",z);
```

Scilab code Exa 1.4 example4

```
//Introductory Topics :example 1-4 : (pg no. 16)
kT=(1.6*10^-20);
f=(1*10^6);
R=(1*10^6);
x=sqrt(kT*f*R);
//4kT at room temperature (17 degree C) is 1.6*10^-20 Joules
printf("\nen = sqrt(4*k*T*delta(f)*R) \nen = %.6f Vrms",x);
```

Scilab code Exa 1.5 example5

```
//Introductory Topics :example 1-5 : (pg no. 16)
k=(1.38*10^-23);
T=(27+273);
f=(4*10^6);
R=100;
x=sqrt(4*k*T*f*R);
// to convert degres to kelvin, add 273 to it
printf("\nen = sqrt(4kT.delta(f)R) \nen = %.8f Vrms",x);
```

Scilab code Exa 1.6 example6

```
//Introductory Topics :example 1-6 : (pg no. 18 &
    19)
x=10;
y=5;
z=(x/y);
a=(10*log10(z));
b=(10*log10(x));
c=(10*log10(y));
d=(b-c);
//part(a)
printf("\nNR = ((Si/Ni)/(So/No)) = %.f",z);
//part(b)
printf("\nNF = 10log((Si/Ni)/(So/No)) =  10logNR \
   nNF = %.f dB",a);
//part(c)
printf("\n 10log(Si/Ni) = %.f dB",b);
printf("\n 10log(So/No) = %.f dB",c);
printf("\ntheir difference = %.f dB",d);
```

Scilab code Exa 1.7 example7

```
//Introductory Topics :example 1-7 : (pg no. 21 &
    22)
BW=200*10^3;
k=(1.38*10^-23);
T=(273+22);//converting degrees C into kelvin
R=(10*10^3);
R1=300;
NF1=3;
NF2=8;
NR1=2;
NR2=6.31;
df=((%pi/2)*BW);
Pn=(k*T*df);
en=sqrt(4*Pn*R);
```

```
x=(14+20+20);//sum of the power gain of the three stages
y=(x/10);
Pg=(10^y);
Po=(Pn*Pg);
eno=sqrt(Po*R1);
pg1=(10^(1.4));
pg2=(10^(20));
NR=(NR1+((NR2-1)/pg1)+((NR2-1)/(pg1*pg2)));
NF=10*log10(NR);
No=(NR*Pn*Pg);
a=sqrt(No*R1);
//part(a)
printf("\ndelta(f)= (pi/2)*BW = %.f Hz",df);//effective noise bandwidth
printf("\nPn = k.T.delta(f) = %.17f W",Pn);// at the input
printf("\nen=sqrt(4.k.T.delta(f).R) = %.8f V",en);//Voltage
printf("\nTpg = 14dB+20dB+20dB = %.f dB",x);//total power gain in decibels
printf("\n54dB = 10logPG \nPG = %.f",Pg);//total power gain
printf("\nPn(out) = Pn(in).PG = %.12f W",Po);//assuming perfect noiseless amplifiers
printf("\nen(out)= %.6f V",eno);//output driven by 300 Ohm load & P=V^2/R
//part(b)
printf("\nPG1=14dB = 25.1 \nPG2=PG3= 20dB =100 \nNF1 = 3dB \nNR1=2 \nNF2=NF3=8dB \nNR2=NR3=6.31");
printf("\nNR=NR1+(NR2-1/PG1)+....+(NRn-1/PG1.PG2...PG(n-1))");//friiss's formula
printf("\nNR = %.3f",NR);//noise ratio
printf("\nNF = %.2f dB",NF);//noise figure
//part(c)
printf("\nNR = (Si/Ni)/(So/No) \nPG = %.1f*10^5",pg1);
printf("\nNR = No/(Ni*PG) \nNo = %.12f W",No);
```

```
printf("\nNo = (en^2)/R \nen= %.6f V",a);//
    outputnoise voltage
```

Scilab code Exa 1.8 example8

```
//Introductory Topics :example 1-8 : (pg no. 24)
k=1.38*10^-23;
T=(35+40+52);//total temperature
df=(1*10^6);
Teq=52;
To=290;
Pn=(k*T*df);
x=(Teq/To);
NR=(x+1);
NF=(10*log10(NR));
printf("\nPn = k.T.delta(f) = %.17f W",Pn);//Noise
    power
printf("\nTeq = To(NR-1) \nNR = %.2f",NR);//noise
    ratio
printf("\nNF = 10log(NR) =%.3f dB",NF);//noise
    figure
```

Scilab code Exa 1.9 example9

```
//Introductory Topics :example 1-9 : (pg no. 25)
x=7*10^-3;
y=0.18*10^-3;
z=10*log10(x/y);
// o/p power measured 400-Hz audio signal modulates
    a carrier
printf("\nS+N+D = %.3f W",x);
// o/p power measured when a filter cancels 400-Hz
    portion of the o/p
```

```
printf("\nN+D = %.5f W",y);
printf("\nSINAD = 10log(S+N+D/N+D)");
printf("\nSINAD = %.1f dB",z);
```

Scilab code Exa 1.10 example10

```
//Introductory Topics :example 1-10 : (pg no. 26)
i= 14*10^-3;//dc current
R=50;
x=(20*i*R);
y=10*log10(x);
printf("\nNR = 20.Idc.R = %.f",x);//noise ratio
printf("\nNF = 10log(NR) = %.2f dB",y);//noise figure
```

Scilab code Exa 1.11 example11

```
//Introductory Topics :example 1-11 : (pg no. 37)
f=(12*10^3);
L=3*10^-3;
C=(0.1*10^-6);
R=30;
x=L*C;
y=sqrt(x);
z=(2*%pi*y);
a=(1/z);
Xl=(2*%pi*f*L);
Xc=(1/(2*%pi*f*C));
b=(Xl-Xc)^2;
c=R^2;
d=sqrt(c+b);
printf("\nfr = 1/2.pi.sqrt(LC) = %.f Hz",a);
//at 12kHz
```

```
printf("\nXL = 2.pi.f.L = %.f Ohm",Xl);
printf("\nXC = 1/2.pi.f.C = %.f Ohm",Xc);
printf("\nZ = sqrt(R^2+(XL-XC)^2) = %.1f Ohm",d);//impedance when f=12 Hz
```

Scilab code Exa 1.12 example12

```
//Introductory Topics :example 1-12 : (pg no. 38 & 39)
R1=20;
R2=1;
L=1*10^-3;
C=0.4*10^-6;
ein=50*10^-3;
f=12*10^3;
x=sqrt(L*C);
y=(1/(2*%pi*x));
eo= ein*(R2/(R2+R1));
XL=(2*%pi*f*L);
XC=(1/(2*%pi*f*C));
a=(R1+R2)^2;
b=(XL-XC)^2;
z=sqrt(a+b);
zo=sqrt((R2^2)+b);
m=(ein*(zo/z));
printf("\nfr = 1/2.pi.sqrt(LC) = %.f Hz",y);//resonant frequency
printf("\neout = ein *(R2/R1+R2) = %.5f V",eo);//o/p voltage at resonance
// at f=12 kHz
printf("\nXL = 2.pi.f.L = %.1f Ohm",XL);
printf("\nXC = 1/2.pi.f.C = %.1f Ohm",XC);
printf("\nZtotal = sqrt((R1+R2)^2 +(XL-XC)^2) = %.1f Ohm",z);
printf("\nZout = sqrt(R2^2)+(XL-XC)^2 = %.1f Ohm",zo
```

```
);
printf("\neout = %.4f V",m);//o/p voltage at 12kHz
```

Scilab code Exa 1.13 example13

```
//Introductory Topics :example 1-13 : (pg no. 40 &
   41)
a=460*10^3;
b=450*10^3;
BW=a-b;
fr=455*10^3;
Q=(fr/BW);
C=0.001*10^-6;
x=(fr*2*%pi);
y=(1/x)^2;
z=y/C;
R=(2*%pi*z*BW);
//part(a) : bandwidth
printf("\nBW = fhc-flc = %.f Hz",BW);
//part(b) : Quality factor
//filter's peak o/p occurs at 455kHz
printf("\nQ = fr/BW = %.1f kHz",Q);
//part(c) : value of inductance
printf("\nfr = 1/2.pi.sqrt(LC) = %.5f H",z);
//part(d): total circuit resistance
printf("\nBW = R/2.pi.L \nR = %.2f Ohm",R);
```

Scilab code Exa 1.14 example14

```
//Introductory Topics :example 1-14 : (pg no. 42)
R=2;
L=3*10^-3;
C=0.47*10^-6;
```

```
x=(2*%pi*sqrt(L*C));
y=1/x;
XL=(2*%pi*y*L);
Q=(XL/R);
Z=((Q^2)*R);
BW=(R/(2*%pi*L));
//part(a) : resonant frequency
printf("\nfr = 1/2.pi.sqrt(LC) = %.f Hz",y);
//part(b) : Quality factor
printf("\nQ = XL/R \n XL =2.pi.f.L \nXL = %.1f Ohm",
    XL);
printf("\nQ = %.1f",Q);
//part(c) : maximum impedance
printf("\nZmax = Q^2*R = %.f Ohm",Z);
//part(d) : Bandwidth
printf("\nBW = R/2.pi.L = %.f Hz",BW);
```

Chapter 2

Amplitude Modulation Transmission

Scilab code Exa 2.1 example1

```
// Amplitude Modulation−Transmission  : example 2−1
   : pg(74 & 75)
//upper sideband is equal to the sum of carrier and
   intelligence frequencies
c=1.4*10^6;
m1=20;
m2=10*10^3;
Ur1=c+m1;
Ur2=c+m2;
Lr1=c-m1;
Lr2=c-m2;
//range of upper sideband(usb)
printf("\nupper sideband will include frequencies
   from  %.f Hz",Ur1 );
printf("\nto \n %.f Hz",Ur2);
//range of lower sideband (lsb)
printf("\nlower sideband will include frequencies
   from  %.f Hz",Lr1);
printf("\nto \n %.f Hz",Lr2);
```

Scilab code Exa 2.2 example2

```
// Amplitude Modulation-Transmission : example 2-2 :
    pg(78)
b=100;
a=60;
d=125;
c=35;
x=180;
y=0;
m1=((b-a)/(b+a))*100;
m2=((d-c)/(d+c))*100;
m3=((x-y)/(y+x))*100;
//part(a)
printf("\npercent(m) = (B-A/B+A)*100percent = %.f
   percent",m1);
//part(b)
printf("\npercent(m) = (B-A/B+A)*100percent = %.f
   percent",m2);
//part(c)
printf("\npercent(m) = (B-A/B+A)*100percent = %.f
   percent",m3);
//part(d) : this is a case of overmodulation
//part(e) : this is a distorted AM wave as the
   increase > decrease in carrier's amplitude
```

Scilab code Exa 2.3 example3

```
// Amplitude Modulation-Transmission : example 2-3 :
    pg(79 & 80)
// m=1 or 100 percent
```

```
//each side frequency = 1/2 the carrier amplitude
//power is proportional to (V)^2
//each side band  power = 1/4 carrier power
c=1*10^3;
esb= 1/4*(c);
tsp=(esb*2);
tp=(tsp+c);
printf("\nESF = mEc/2 ");
printf("\nCarrier power = %.f W",c);
printf("\n Each side-band power = 1/4 of carrier power = %.f W",esb);
printf("\nTotal side-band power = %.f W",tsp);
printf("\nTotal transmitted power = %.f W",tp);
```

Scilab code Exa 2.4 example4

```
// Amplitude Modulation-Transmission : example 2-4 : pg(81)
m=0.9; //modulation index
Pc=500; //carrier Power
x=(m^2)/2;
y=(1+x)*Pc;
printf("\nPt = Pc*(1+(m^2)/2)");
printf("\nPt = %.1f W",y);//total transmitted powwer
```

Scilab code Exa 2.5 example5

```
// Amplitude Modulation-Transmission : example 2-5 : pg(81)
m=0.95;//modulation index
Pt= 50*10^3;//total transmitted power
x=(m^2)/2;
y=1+x;
```

```
z=(Pt/y);
Pi=Pt-z;
printf("\nPt = Pc*(1+(m^2)/2)");
printf("\nPc = %.f W",z);//carrier power
printf("\nPi = Pt-Pc = %.f W",Pi);//intelligence signal
```

Scilab code Exa 2.6 example6

```
// Amplitude Modulation-Transmission : example 2-6 : pg(81 & 82)
Ic=12;//antenna current of AM transmitter when unmodulated
It=13;//current when modulated
x=2*((13/12)^2-1);
m=sqrt(x);
a=m*100;
printf("\nIt = Ic.sqrt(1+(m^2)/2) \nm^2 = %.2f ",x);
printf("\nm = %.2f",m);
printf("\npercent(m) = %.f percent",a);//percentage of modulation
```

Scilab code Exa 2.7 example7

```
// Amplitude Modulation-Transmission : example 2-7 : pg(82)
n=0.7;//efficiency
c=10*10^3;//carrier wave
Is=0.5*c;//intelligence signal
p=(Is/n);
printf("\ndc input power = %.f W",p);//dc input power
```

Scilab code Exa 2.8 example8

```
// Amplitude Modulation-Transmission : example 2-8 :
    pg(82 & 83)
Pc=10*10^3;//carrier power
Pt=11.2*10^3;//transmitted power
m2=0.5;//modulation index of another sine wave
x=2*((Pt/Pc)-1);
m=sqrt(x);
meff=sqrt((m^2)+(m2^2));
a=Pc*(1+((meff^2)/2));
printf("\nPt = Pc.(1+m^2/2) \nm=%.2f",m);
printf("\nmeff = sqrt(m1^2+m2^2) \nmeff = %.1f",meff
   );//effective modulation index
printf("\nPt = Pc.(1+m^2/2) \n Pt = %.f W",a);//
   total transmitted power
```

Scilab code Exa 2.9 example9

```
// Amplitude Modulation-Transmission : example 2-9 :
    pg(100)
a=1;
b=0.03;
c=0.05;
d=0.02;
e=0.04;
x=sqrt((b^2+c^2+d^2+e^2)/a^2);
y=x*100;
printf("\nTHD = sqrt((V2^2)+(V3^3)+(V4^2)+(V5^2)/(V1
   ^2)) \nTHD = %.5f",x);
printf("\nTHD = %.2f percent",y);//total harmonic
   distortion
```

Chapter 3

Amplitude Modulation Reception

Scilab code Exa 3.1 example1

```
// Amplitude Modulation-Reception : example 3-1 : (pg 120)
fr=550*10^3;
L=10*10^-6;
fr1=1550*10^3;
a=fr*2*%pi;
x=fr1*2*%pi;
b=1/a;
y=1/x;
C1=((b)^2/L);
C2=((y)^2/L);
fr2=1100*10^3;
BW=10*10^3;
Q=(fr2/BW);
BW1=(fr1/Q);
BW2=(fr/Q);
//part(a) : calculate C at 550kHz
printf("\nfr = 1/2.pi.(LC) \nC1= %.12f F",C1);
//at 1550 kHz
```

```
printf("\nC2 = %.11f F",C2);
printf("\nrequired range of capacitance is from 1.06
    to 8.37 nF");
//part(b) : Quality factor
printf("\nQ = fr/BW \nQ = %.f Hz",Q);
//part(c) : Q at 1550 kHz
printf("\nBW = fr/Q \nBW = %.f Hz",BW1);
// Q at 550 kHz
printf("\nBW = %.f Hz",BW2);
```

Scilab code Exa 3.2 example2

```
// Amplitude Modulation-Reception : example 3-2 : (
   pg 134)
f=620*10^3;
IF=455*10^3;
LO=f+IF;
X=IF+LO;
// image frequency of local oscillator
//station frequency = 620 kHz
printf("\nLO - 620 kHz = IF");
printf("\nLO = %.f Hz",LO);
// determining at what other frequency, when mixed
   with 1075kHz,yields an o/p component at 455kHz
printf("\nX-1075kHz=IF \nX = %.f Hz",X);
```

Scilab code Exa 3.3 example3

```
// Amplitude Modulation-Reception : example 3-3 : (
   pg 150 & 151)
V=8*10^-6;
R=50;
P=(V^2)/R;
```

```
dBm=10*log10(P/0.001);
dBW=10*log10(P/1);
a=(-89+8+3+24+26+26-2+34);
x=(a/10);
y=10^x;
z=y*0.001;
printf("\nP = V^2/R = %.15f W",P);//input power in
    Watts
printf("\ndBm = 10log(P/1mW) = %.f dBm",dBm);//input
    power in dBm
printf("\ndBW = 10log(P/1W) = %.f dBW",dBW);//input
    power in dBW
printf("\nPout(dBm) = %.f dBm into speaker",a);//o/p
    power in dBm
printf("\nPout(dBW) = %.f W",z);
```

Chapter 4

Single Sideband Communications

Scilab code Exa 4.1 example1

```
//Single-Sideband Communications : example 4-1 : (pg
    172 & 173)
x=1*10^6;
y=10^(80/20);
z=sqrt(y);
df=200;
Q=(x*z)/(4*df);
a=100*10^3;
Q1=(a*z)/(4*df);
disp(Q1);
//part(a) : Q when 1-MHz & 80-dB sideband
    suppression
printf("\nQ1 = fc.(log^-1(dB/20)^1/2)/4*delta(f) = %
    .f",Q);
//part(b) : Q when 100-kHz & 80-dB sideband
    suppression
printf("\nQ2 = fc.(log^-1(dB/20)^1/2)/4*delta(f) = %
    .f",Q1);
```

Scilab code Exa 4.2 example2

```
//Single-Sideband Communications : example 4-2 : (pg
    178)
a=3*10^6;
b=3.1*10^6;//new DSB signal range
c=2.9*10^6;//new DSB signal range
Q=(a/(b-c));
printf("\nthe required filter Q is = %.f",Q);
```

Scilab code Exa 4.4 example4

```
//Single-Sideband Communications : example 4-4 : (pg
    187)
a=455;
x=2000+1;
y=2000+3;
c=2000+455;
d=2455-2001;
e=2455-2003;
f=455-454;
g=455-452;
mprintf("\nRF and first mixer input: \n %.f kHz \n%.
   f kHz",x,y);
printf("\nlocal oscillator = %.f kHz",c);
mprintf("\nFirst mixer output: \n%.f kHz \n%.f kHz",
   d,e);//IF amp and second mixer input
printf("\nBFO = %.f kHz",a);
mprintf("\nSecond mixer output & audio amp: \n%.f
   kHZ \n%.f kHz",f,g);
```

Chapter 5

Frequency Modulation Transmission

Scilab code Exa 5.1 example1

```
//Frequency Modulation : Transmission : example 5-1
   : (pg 209)
v=25*10^-3;
f=750;//deviation constant
vg=10*10^-3;//deviation constant
pfd=v*(f/vg);//positive frequency deviation
nfd=-v*(f/vg);//negative frequency deviation
//part(a)
printf("\npositive frequency deviation = %.f Hz",pfd
   );
printf("\nnegative frequency deviation = %.f Hz",nfd
   );
mprintf("\nThe total deviation is written as +-2.25
   kHz for the given input signal level");
//part(b)
printf("\nThe input frequency (fi) is 400 Hz
   therefore, by eqn \nfout = fc+kei");
mprintf("\nThe carrier wil deviate %.f Hz and %.f Hz
    at a rate of 400 Hz",pfd,nfd);
```

Scilab code Exa 5.3 example3

```
//Frequency Modulation : Transmission : example 5-3
   : (pg 214)
d=20*10^3;
fi=10*10^3;
mf=d/fi;
a=mf*40;
printf("\nmf = %.f",mf);//maximum deviation
printf("\nJ0,J1,J2,J3,J4 are the significant
   components are obtained");//from Bessel func
printf("\nJ1=+-10kHz \nJ2=+-20kHz \nJ3 = +-30kHz \
   nJ4=+-40kHz");
printf("\ntotal required bandwidth is %.f kHz",a);
```

Scilab code Exa 5.4 example4

```
//Frequency Modulation : Transmission : example 5-4
   : (pg 214)
d=20*10^3;
fi=5*10^3;
mf=d/fi;
a=2*35;
printf("\nmf = %.f",mf);
printf("\nhighest significant side-frequency
   component is J7");//from bessel function
printf("\nrequired bandwidth is %.f kHz",a);
```

Scilab code Exa 5.5 example5

```
//Frequency Modulation : Transmission : example 5-5 : (pg 215)
fc=(2*%pi*(10^8))/2*%pi;
Vm=2000;
R=50;
P=(2000/sqrt(2))^2/R;
mf=2;//by inspection of FM equation
fi=(%pi*10^4)/(2*%pi);
d=(mf*fi);
BW=mf*40;
bw=2*(d+fi);
P1=((0.58*2000/sqrt(2))^2)/R;
P2=((0.3*2000/sqrt(2))^2)/R;
//part(a)
printf("\nfc = %.f Hz",fc);//by inspection of FM equation
//part(b)
printf("\nthe peak voltage is 2000V \nP = %.f W",P);
//part(c)
printf("\nmf = 2");//by inspection of FM equation
//part(d)
printf("\nthe intelligence frequency fi = %.f Hz",fi);
//part(e)
printf("\nmf = d/fi \nd = %.f Hz",d);//d is maximum deviation
printf("\nas mf=2,significant sidebands exist to J4 \nBW = %.f Hz",BW);
printf("\n BW = %.f Hz",bw);//using carson's rule (BW = 2(dmax+fimax))
//part(f)
printf("\nJ1 is the largest sideband at at 0.58 times the unmodulated carrier amplitude");
printf("\nP = %.f W",P1);
printf("\nor 2*135 = 27kW for two sidebands at +-5 kHz from carrier");
printf("\nThe smallest sideband J4 is 0.03 times the carrier = %.f W",P2);
```

Scilab code Exa 5.6 example6

```
//Frequency Modulation : Transmission : example 5-6
   : (pg 218)
d=75*10^3;
fi=30*10^3;
fi1=15*10^3;
d1=1*10^3;
fi2=100;
fi3=2*10^3;
a=d/fi;
b=d/fi1;
c=d1/fi2;
d=d1/fi3;
DR=d1/fi3;
//part(a)
printf("\nThe maximum deviation in broadcast FM is
   75 kHz");
printf("\nmf = %.f",a);//for fi=30kHz
printf("\nFor fi = 15kHz, \nmf1 = %.f",b);
//part(b)
printf("\nmf2 = %.f",c);//for fi=100Hz and d=1kHz
printf("\nfor fi=2kHz \nmf3 = %.f",d);
printf("\nDR = fdev(max)/fi(max) = %.1f",DR);//
   deviation ratio
```

Scilab code Exa 5.7 example7

```
//Frequency Modulation : Transmission : example 5-7
   : (pg 218 & pg 219)
mf=0.25;
```

```
a=0.98;
b=0.12;
x=10*10^3;
P=(a^2)*x;
P1=(b^2)*x;
t=P+2*P1;
printf("\nFor mf=0.25,the carrier is equal to0.98
   times its unmodulated amplitude & the only
   significant sideband is J1 with a relative
   amplitude of 0.12");
printf("\ncarrier power = %.f W",P);
printf("\npower of each sideband = %.f W",P1);
printf("\ntotal power = %.f W",t)
```

Scilab code Exa 5.8 example8

```
//Frequency Modulation : Transmission : example 5-8
   : (pg 222)
phi=0.5;
fi=5*10^3;
d=phi*fi;
x=75*10^3;
y=x/d;
printf("\nThe i/p =2 means that the worst case
   deviation is about 1/2 rad");
printf("\nd = %.f Hz",d);
printf("\nbecause full volume in broadcast FM
   corresponds to 75kHz deviation");
printf("\no/p S/N = %.f",y);
```

Scilab code Exa 5.9 example9

```
//Frequency Modulation : Transmission : example 5-9
   : (pg 222 & 223)
dm=10*10^3;
x=(1/3);//N/S input ratio
phi=asind(x);
phi1=asin(x);
fi=3*10^3;
d=phi1*fi;
a=dm/d;
printf("\nThe worst-case phase shift dur to the
   noise occurs when phi=asin(N/S)");
mprintf("\nphi = %.1f degrees or %.2f rad",phi,phi1)
   ;
printf("\nd= %.f Hz",d);
printf("\nThe S/N output will be %.f",a);
```

Chapter 6

Frequency Modulation Reception

Scilab code Exa 6.1 example1

```
//Frequency Modulation - Reception : example 6-1 : (
   pg 265)
G=200000;
v=200*10^-3;//quieting voltage
in=v/G;
printf("\nTo reach quieting, the input must be %.8f
   V",in);//reciever's sensitivity
```

Scilab code Exa 6.2 example2

```
//Frequency Modulation - Reception : example 6-2 : (
   pg 272)
f=10*10^6;
f1=50*10^3;
f2=200*10^3;
x=f1*2;
```

```
y=f2*2;
printf("\nThe capture occurred at %.f Hz from the free-running VCO frequency.",f1);
printf("\nAssume symmetrical operation,which implies a capture range of %.f Hz",x)
mprintf("\nOnce captured the VCO follows the input to a %.f Hz deviation,implying a lock range of %.f Hz",f2,y);
```

Chapter 7

Communication Techniques

Scilab code Exa 7.6 example

```
//Communication Techniqu;es : example 7-6 : (pg 304)
Q=60;
IF=455*10^3;
x=680*10^3;
imf=x+2*(IF);//image frequency
a=(imf/x);
b=(x/imf);
c=(Q*(a-b));
d=20*log10(c);
printf("\nimage rejection(dB)=20log((fi/fs-fs/fi).Q)
   ");
printf("\nThe image frequency is %.f Hz",imf);
printf("\nimage rejection = %.f dB",d);
```

Scilab code Exa 7.7 example7

```
//Communication Techniqu;es : example 7-7 : (pg 314)
NF=20;
```

```
df=10^6;
x=10*log10(df);
S=-174+NF+x;
a=5;//input intercept
dr=2/3*(a-S);
printf("\nS = -174dBm + NF + 10log10df + S/N = %.f
    dB",S);//sensitivity
printf("\ndynamic range = 2/3.(input intercept-noise
     floor) = %.d dB",dr);
```

Scilab code Exa 7.8 example8

```
//Communication Techniqu;es : example 7-8 : (pg 315)
nf=5;
x=24;
y=20;
NR0=10^(nf/10);
NR1=10^(y/10);
PG1=10^(x/10);
NR=NR0+((NR1-1)/PG1);
NF=10*log10(NR);
S=-174+NF+60;
a=nf-x;//the system's third-order intercept point
dr=2/3*(a-S);
printf("\nNR = antilog(NF/10)");//noise ratio
printf("\nNR1 = %.2f",NR0);
printf("\nNR2 = %.f",NR1);
printf("\nOverall NR = NR1+NR2-1/PG1");
printf("\nPG1= antilog(24dB/10) = %.f",PG1);
printf("\nNR = %.2f",NR);
printf("\nNF = %.1f dB",NF);//total system noise
    figure
printf("\nS = %.1f dBm",S);//sensitivity
printf("\nthe systems third-order intercept point is
     %.f dBm",a);
```

```
printf("\ndynamic range = %.1f dB",dr);
```

Scilab code Exa 7.9 example9

```
//Communication Techniqu;es : example 7-9 : (pg 315
   & 316)
x=24;
nf=-5;
NR = 3.16+(99/10);
NF = 10*log10(NR);
S=-174+NF+60;
dr = 2/3*(nf-S);
printf("\nNR = %.1f",NR);//noise ratio
printf("\nNF = %.1f dB",NF);//noise figure
printf("\nS = %.1f dBm",S);//sensitivity
printf("\ndynamic range = %.1f dB",dr);
```

Scilab code Exa 7.10 example10

```
//Communication Techniqu;es : example 7-10 : (pg
   329)
x=0.40*100*10^6;
y=(100*10^6/(2^32));
//fCLK is reference oscillator
printf("\nThe maximum output frequency is
   approximately 40 percent of fCLK MAX");
printf("\n %.f Hz",x);
printf("\nThe frequency resolution is given by fCLK
   / 2^N");
printf("\n%.3f Hz",y);
```

Chapter 8

Digital Communication Coding Technique

Scilab code Exa 8.1 example1

```
//Digital Communication-Coding Techniques : example
   8-1 : (pg 357)
fa=20*10^3;
fs=2*fa;//minimum sample rate
printf("\nfs >= 2.fa \nfs >= %.f Hz",fs);
```

Scilab code Exa 8.2 example2

```
//Digital Communication-Coding Techniques : example
   8-1 : (pg 362)
dr=55;
n=(dr/6.02);
x=(1.76+(6.02*10));//signal-to-noise ratio for
   digitizing system
l=2^10;
y=10*log10(3*(l^2));//signal-to-quantization-noise
   level
```

```
printf("\nDR = 6.02dB/bit(n) \n n= %.3f",n);
printf("\nS/N = %.2f dB",x);
printf("\nL = 2^10 = %.f",l);
printf("\n(S/N)q(dB) = 10log3L^2 = %.2f dB",y);
```

Scilab code Exa 8.3 example3

```
//Digital Communication-Coding Techniques : example
   8-3 : (pg 368)
R=100*10^3;
Rf=10*10^3;
Vref=-10;
Vo=-(Vref)*(Rf/R);// resolution
a=(10/100);
b=(10/50);
c=(10/25);
d=(10/12.5);
V=-(Vref)*(a+b+c+d);//output voltage
printf("\nThe step-size is determined by leaving all
    switches open and closing the lsb");
printf("\nVo = -(-10V)(Rf/R) = %.1f",Vo);
printf("\nThe resolution is 1.0. If all switches are
    closed,a logic 1 is input.");
printf("\nVo = %.f V",V);
```

Scilab code Exa 8.4 example4

```
//Digital Communication-Coding Techniques : example
   8-4 : (pg 375)
d=2;
d1=3;
d2=4;
x=d-1;
```

```
a=(d/2)-1;
y=d1-1;
b=1/2*(d1-1);
z=d2-1;
c=(d2/2)-1;
//part (a)
printf("\nDmin = 2, the no. of error detected is (
    Dmin-1) = %.f",x);
printf("\nDmin is even, the no. of errors corrected
    equal = (Dmin/2)-1 = %.f",a);
printf("\nDmin = 3, the no. of error detected is (
    Dmin-1) = %.f",y);
printf("\nDmin is odd, the no. of errors corrected
    equal = (Dmin/2)-1 = %.f",b);
printf("\nDmin = 4, the no. of error detected is (
    Dmin-1) = %.f",z);
printf("\nDmin is even, the no. of errors corrected
    equal = (Dmin/2)-1 = %.f",c);
```

Chapter 9

Wired Digital Communications

Scilab code Exa 9.1 example1

```
//Wired Digital Communications : example 9-1 : (pg
   405 & 406)
M=110;
x=7;
n=log2(M);
a=(log10(110)/log10(2));
b=2^a;
u=(a/x)*100;
y=log10(b);
u1=(y/3)*100;
printf("\nIn binary system, n=log2M = %.2f",n);//
   number of bits
printf("\n2^6.78 = %.f",b);
printf("\n7 bits are required and efficiency is u =
   %.f percent",u);
printf("\nIn a decimal system, the number of dits
   required is %.f i.e total of 3 dits",y);
printf("\nThe efficiency is %.f percent",u1);
```

Scilab code Exa 9.2 example2

```
//Wired Digital Communications : example 9-2 : (pg
   407)
m=10^7;
Pe=10^-6;//error probability
a=m*Pe;//average number of errors
printf("\naverage number of errors = m*error
   probability(Pe) \n= %.f",a);
mprintf("\n%.f expected bit errors if %.f million
   bits are recieved",a,a);
```

Scilab code Exa 9.3 example 3

```
//Wired Digital Communications : example 9-3 : (pg
   407)
Tb=1/9600;//bit frequency
Pt=0.8;//transmit power
Eb=Pt*Tb;//energy per bit
printf("\nbit frequency = %.7f",Tb);
printf("\nEb = Pt.Tb =%.8f J",Eb);
```

Scilab code Exa 9.4 example4

```
//Wired Digital Communications : example 9-4 : (pg
   410)
bw=3*10^3;//bandwidth
x=1023;//signal-to-noise ratio
C=bw*log2(1+x);//capacity of telephone channel
printf("\nthe telephone channel has a bandwidth of
   about %.f Hz",bw);
printf("\nC = BW.log2(1+S/N) = %.f bits per second",
   C);
```

Scilab code Exa 9.5 example4

```
//Wired Digital Communications : example 9-5 : (pg
    411)
Tb=1/(8*10^3);//bit frequency
BWmin=1/(2*Tb);//minimum bandwidth
printf("\nTb = %.8f s",Tb);
printf("\nBWmin = 1/2.Tb = %.f Hz",BWmin);
```

Chapter 10

Wireless Digital Communication

Scilab code Exa 10.2 example2

```
//Wireless Digital Communications : example 10-2 : (
   pg 467)
n=3;
n1=7;
x=(2^n)-1;
y=(2^7)-1;
//part(a)
mprintf("\n n=%.f,PN sequence length = %.f",n,x);
//part(b)
mprintf("\n n=%.f,PN sequence length = %.f",n1,y);
```

Scilab code Exa 10.3 example3

```
//Wireless Digital Communications : example 10-3 : (
   pg 477)
x=56;//modulation bit rate
```

```
y=560;//chip rate
a=256;//modulation bit rate
b=1792;//chip rate
z=y/x;
c=b/a;
//part(a)
printf("\nSpreading = %.f",z);
printf("\nSpreading = %.f",c);
```

Chapter 12

Transmission Lines

Scilab code Exa 12.1 example1

```
//Transmission Lines : example 12-1 : (pg 575)
L=73.75*10^-9;
C=29.5*10^-12;
Z=sqrt(L/C);
x=5280;
z=sqrt((x*L)/(x*C));
printf("\nFor the 1-ft section , \nZ0 = sqrt(L/C) = %
    .f Ohm",Z);
printf("\nFor the 1-mi section , \nZ0 = %.f Ohm",z);
```

Scilab code Exa 12.2 example2

```
//Transmission Lines : example 12-2 : (pg 574 & 575)
a=2;//parallel wire line
//D/d where D is spacing between the wires n d is
    diameter of 1 conductor
b=2.35;//coaxial line
D=0.285;
```

```
d=0.08;
e=1;//dielectric constant of insulating material relative to air
z=(276/e)*log10(2*2);
z1=(138/e)*log10(b);
z2=(138/sqrt(2.3)*log10(D/d));
//part(a) Zo of parallel wire with D/d = 2
printf("\nZo = 276/sqrt(e).log10.(2D/d) = %.f Ohm",z);
//part(b) Zo of coaxial line with D/d = 2.35
printf("\nZo = 138/sqrt(e).log10.(D/d) = %.1f Ohm",z1);
//part(c) Zo of RG-8A/U coaxial cable with D=0.285 in. & d=0.08 in.
printf("\nZo = 138/sqrt(2.3).log10.(D/d) = %.f Ohm",z2);
```

Scilab code Exa 12.3 example3

```
//Transmission Lines : example 12-3 : (pg 579)
L=73.75*10^-9;
C=29.5*10^-12;
d=1;//distance
t=sqrt(L*C);
Vp=d/t;
printf("\nthe delay introduced is t = sqrt(L.C) = %.11f s",t);
printf("\nThe velocity of propagation is, \nVp = d/sqrt(L.C) = %.f ft/s",Vp);
```

Scilab code Exa 12.4 example4

```
//Transmission Lines : example 12-4 : (pg 580)
```

```
v=2.07*10^8;//velocity
c=3*10^8;//velocity of light
Er=2.3;//relative dielectric constant
vf=(v/c);//velocity factor
vf1=1/sqrt(Er);
printf("\nThe velocity was 2.07*10^8 m/s \nvf = %.2f
  ",vf);
printf("\nvf = 1/sqrt(Er) = %.2f",vf1);
```

Scilab code Exa 12.5 example5

```
//Transmission Lines : example 12-5 : (pg 581)
c=3*10^8;//speed of light
f=100*10^6;//frequency of signal
x=2.07*10^8;//velocity of wave propagation
w=c/f;//wavelength in free-space
w1=x/f;//wavelength while traveling through an RG-8A
  /U coaxial cable
printf("\nIn free space, lambda = c/f = %.f m",w);
printf("\nWhile traveling through RG-8A/U cable,
  lamda = c/f = %.2f m",w1);
```

Scilab code Exa 12.7 example7

```
//Transmission Lines : example 12-7 : (pg 592 & 593)
Zl=300;//load impedance
Zo=50;//characteristic impedance
v=2.07*10^8;//velocity in RG-8A/U cable
f=27*10^6;//operating frequency of citizen's band
  transmitter
Po=4;//output power of transmitter
l=10;//length of RG-8A/U cable
Rl=300;//input resistance of antenna
```

```
T=((Zl-Zo)/(Zl+Zo));//reflection coefficient
h=v/f;//length of cable in wavelength
le=l/h;//electrical length
x=Rl/Zo;//VSWR
y=((1+T)/(1-T));//VSWR
rp=(T)^2*Po;//reflected power
Pl=Po-rp;//load power
//part(a): The reflection coefficient
printf("\nT = ZL-Z0/ZL+Z0 = %.2f",T);
//part(b) : The electrical length of the cable in
   wavelengths(h)
printf("\nh = v/f = %.2f m",h);
mprintf("\nBecause the cable is 10m long,its
   electrical length is (%.f m)/(%.2f m/wavelength)
   = %.1fh",l,h,le);
//part(c) : The VSWR
printf("\nBecause load is resistive, \nVSWR = %.f",x
   );
printf("\nAn alternativr solution, because T is
   known, \nVSWR = 1+T/1-T = %.f",y);
//part(d) : absorbed power
mprintf("\nthe reflected voltage is T times the
   incident voltage,\nreflected voltage = %.2f W \
   nPload = %.2f W",rp,Pl);
```

Scilab code Exa 12.8 example8

```
//Transmission Lines : example 12-8 : (pg 597)
Zo=100;//characteristic impedance
j=%i;
Zl = 200-j*150;//load impedance
l=4.3;//length of transmission line
x=200/Zo;
y=150/Zo;
a=0.4*Zo;
```

```
b=0.57*Zo;
mprintf("\nTo normalize the load impedance: \nzL = ZL/Zo  = %.f - j*%.1f",x,y);
//VSWR and equation of zin should b drawn from impedance smith chart,the plotted points should be read
printf("\n zin = 0.4 + j*0.57");//from smith chart
mprintf("\nZin = zin*Zo = %.f Ohm + j* %.f Ohm",a,b);
```

Scilab code Exa 12.9 example9

```
//Transmission Lines : example 12-9 : (pg 599)
j=%i;
RL=120;//load resistance from smith chart
ZL=75+j*50;//load impedance
Z0=50;//characteristic impedance
a=75/Z0;
y=50/Z0;//normalized load impedance
z=2.4;//normalized z at a point that is purely resistive
ar=z*Z0;//actual resistance
x=sqrt(Z0*RL);
printf("\nzl = ZL/Z0 = %.1f + j*%.f",a,y);
//VSWR,zin,R can be found out from smith chart manually
printf("\nZ0^ = sqrt(Z0*RL) = %.1f Ohm",x);//characteristic impedance of matcing section
//^ indicates (') complement sign
```

Scilab code Exa 12.10 example10

```
//Transmission Lines : example 12-10 : (pg 601)
```

```
Z0=75;//characteristic impedance
j=%i;
ZL=50-j*100;//load impedance
x=50/Z0;
y=100/Z0;
mprintf("\nzL = ZL/Z0 = %.2f - j* %.2f",x,y);
//rest of the values have to be calculated manually
   by smith chart or by using smith chart's
   softwares
```

Chapter 13

Wave Propagation

Scilab code Exa 13.1 example1

```
//Wave Propagation : example 13-1 : (pg 628)
x=(2*(1/2));
a=15;
d=53.5*10^-6;//duration for each horizontal line on
    the reciever
t=1/186000;//time delay between direct and reflected
     signal
g=(t/d)*a;//ghost width
printf("\nt = d/v = %.8f",t);
printf("\nghost width = %.2f in.",g);
```

Scilab code Exa 13.2 example2

```
//Wave Propagation : example 13-2 : (pg 641 & 642)
S=83;//satellite longitude in degrees
N=90;//site longitude in degrees
L=35;//site latitude in degrees
G=S-N;
```

```
a=atand(-0.128/0.5736);
A=180+a;
x=cosd(G)*cosd(L);
b=0.1512;
d=x-b;
n=(cosd(G))^2;
m=(cosd(L))^2;
o=1-(m*n);
w=sqrt(o);
y=d/w;
E=atand(y);
printf("\nThe azimuth is equal to A = 180+arctan(tanG/tanL) = %.f degrees",A);
printf("\nThe elevation calculated ,\ntan(E)=cosG.cosL-0.1512/sqrt(1-cos^2G.cos^2L) = %.4f",y);
printf("\nE = %.3f degrees",E);
```

Scilab code Exa 13.3 example3

```
//Wave Propagation : example 13-3 : (pg 646)
x=(32+(44/60)+(36/3600));// N latitude
y=(106+(16/60)+(37/3600));//W longitude
D=42.1642*10^6;//distance from the satellite to the center of the earth
R=6.378*10^6;//earth's radius
a=32.74333;
B=-7.27694;
m=D^2;
n=R^2;
e=2*D*R;
q=cosd(a)*cosd(B);
d=sqrt(m+n-(e*q));
c=2.997925*10^5;//velocity of light
de=d/c;
rd=(2*d)/c;
```

```
printf("\n N latitude \nconverted into degrees = %.5f",x);
printf("\n W longitude \n coverted into degrees = %.7f",y);
printf("\nd = sqrt(D^2 + R^2 - 2.D.R.cosa.cosB) = %.f meters",d);
printf("\ndelay = d/c  and roundtrip delay = 2d/c ");
printf("\ndelay = 0.%.f seconds",de);
printf("\nroundtrip delay = 0.%.f seconds",rd);
```

Scilab code Exa 13.4 example4

```
//Wave Propagation : example 13-4 : (pg 651 & 652)
G=45;//antenna gain
nt=25;//antenna noise temperature
nt1=70;//LNB noise temperature
nt2=2;//noise temperature(reciever and passive components)
T=nt+nt1+nt2;//total noise temperature
x=G-10*log10(T);//figure of merit
printf("\nSum of all of the noise temperature contributions \nTs = %.f K",T);
printf("\nThe figure of merit (G/T) \nG/T = G-10.log(Ts) = %.2f dB",x);
```

Scilab code Exa 13.5 example5

```
//Wave Propagation : example 13-5 : (pg 652 & 653)
d=41.130383*10^6;//distance
c=2.997925*10^8;//velocity of light
f=14.25*10^9;//uplink frequency
h=c/f;//wavelength
```

```
x=(4*%pi*d)/h;
Lp=20*log10(x);//free-space path loss
printf("\nThe wavelength is calculated by, \nh=c/f =
    %.6f",h);
printf("\nThe free-space path loss(Lp) expressed in
   dB");
printf("\nLp(dB)= 20log(4.pi.d/h) = %.3f dB",Lp);
```

Chapter 14

Antennas

Scilab code Exa 14.1 example1

```
//Antennas : example 14-1 : pg(669)
c=3*10^8;
f=150*10^6;
h=c/f;
x=1/2;
D=0.5*2;
Rff=5*D;
printf("\nThe wavelength (h) for a h/2 dipole at 150
    MHz is , \nh=c/f = %.f m/cycle",h);
printf("\nh/2 = 1m, which is the antennas dimension(
    D) \nD/h = 1/2 = %.1f",x);
printf("\n Rff = 5D = %.f m",Rff);
```

Scilab code Exa 14.2 example2

```
//Antennas : example 14-2 : pg(669)
c=3*10^8;//velocity of light
f=12*10^9;//frequency
```

```
D=4.5;//diameter of parabolic reflector
h=c/f;//wavelength
x=D/h;
R=(2*D^2)/h;
printf("\nThe wavelength, \nh= %.3f m/cycle",h);
printf("\nD=4.5 meter \nD/h = %.f",x);
printf("\nselect equation, \nR > %.f m",R);
```

Scilab code Exa 14.3 example3

```
//Antennas : example 14-3 : pg(671)
Pt=10;//transmitted power
//dipoles have gain 2.15dB
Gr=10^(2.15);//recieving antenna gain(ratio)
    compared to isotropic radiator
Gt=Gr;//transmiting antenna gain(ratio) compared to
    isotropic radiator
Gr=1.64;
c=3*10^8;//velocity of light
f=144*10^6;//frequency
d=50*10^3;//distance between antennas
x=c/f;//wavelength
y=x^2;
z=Pt*Gt*Gr*y;
a=(16*(%pi)^2);
b=a*(d^2);
Pr=z/b;//power recieved
printf("\nPr = Pt.Gt.Gr.h^2/16.pi^2.d^2 = %.12f W",
    Pr);
```

Scilab code Exa 14.4 example4

```
//Antennas : example 14-4 : pg(674)
```

```
c=3*10^8;//velocity of light
f=100*10^6;//frequency
h=c/f;//wavelength
x=h/2;//dipole i.e h/2
l=0.95*x;//applying 95% correction,the actual
    optimum physical length
L=486/100;//alternative method to find length
printf("\nAt 100MHz, \nh=c/f = %.f m",h);
printf("\nlength of antenna = %.2f m",l);
mprintf("\nalternate method, L = 486/f = %.2f ft
    which is equal to %.2f m",L,l);
```

Chapter 16

Microwaves and Lasers

Scilab code Exa 16.1 example1

```
//Microwaves and Lasers : example 16-1 : pg(753)
h=0.3;//curve depth of parabolic reflector
D=3;//diameter of parabolic reflector
f=D/(16*h);//focal length
printf("\nFocal length(f)= D/16.h = %.3f m",f);
mprintf("\nThe focal length is %.3f m out from the
   center of the parabolic reflector",f);
```

Scilab code Exa 16.2 example2

```
//Microwaves and Lasers : example 16-2 : pg(755)
D=3;//diameter of microwave dish
k=0.6;//efficiency of reflector
c=2.997925*10^8;//velocity of light
f=10*10^9;//frequency
h=c/f;//wavelength
x=(%pi*D)^2;
y=(h^2);
```

```
a=k*(x/y);
Ap=10*log10(a);//powergain
B=(70*h)/D;//beamwidth
printf("\nAp(dBi)=10logk(pi.D)^2/(h^2)");
printf("\nh= c/f = %.3f m",h);
printf("\nAp(dBi) = %.2f dBi",Ap);
printf("\nbeamwidth = 70h/D = %.1f degrees",B);
```

Scilab code Exa 16.3 example3

```
//Microwaves and Lasers : example 16-3 : pg(756)
D=4.5;//diameter of parabolic reflector
k=0.62;//efficiency factor
x=(D/2)^2;
y=(k*%pi);
Ae=y*x;//aperture efficiency
i=(%pi*x);//ideal capture area
printf("\nAe = k.pi(D/2)^2 sq.m = %.2f sq.m",Ae);
mprintf("\nThe ideal capture area for %.1f m
    parabolic antenna is pi.(D/2)^2 = %.1f sq.m",D,i)
    ;
```

Chapter 17

Television

Scilab code Exa 17.1 example1

```
//Television : example 17-1 : pg(822)
bw=5*10^6;//bandwidth
t=53.5*10^-6;//time allocated for each visible trace
T=2*bw*t;//increase in horizontal resolution
mprintf("\nThe %.8f s allocated for each visible
    trace could now a develop a maximum %.f Hz video
    signal",t,bw);
printf("\nThus, the total number of vertical lines
    resolvable is %.f lines",T);
```

Scilab code Exa 17.2 example2

```
//Television : example 17-2 : pg(822)
bw=5*10^6;//bandwidth
l=428;//horizontal resolution
t=l/(bw*2);//trace time
x=1/30;//time available for a full picture
y=t+10*10^-6;//assuming that 10us is used for
    horizontal blanking
```

```
n=x/y;//no. of horizontal traces
c=600*0.7;//allowing 32 lines for vertical retrace
printf("\ntrace time = %.8f s",t);
printf("\ntotal no. of horizontal traces = %.f lines
  ",n);
printf("\nvertical resolution = %.f lines",c);
```

Chapter 18

Fibre Optics

Scilab code Exa 18.1 example1

```
//Fibre Optics : example 18-1 : pg(859)
c=3*10^8;//velocity of light
f=4.4*10^14;//frequency of red light
f1=7*10^14;//frequency of violet light
h1=c/f;//wavelength of red light
h2=c/f1;//wavelength of violet light
printf("\nFor red, \nh = c/f = %.9f m",h1);
printf("\nFor violet \nh = c/f = %.9f m",h2);
```

Scilab code Exa 18.2 example2

```
//Fibre Optics : example 18-1 : pg(859)
n1=1.535;//refractive index of fibre optics
n2=1.490;//refractive index of cladding
x=(n1^2)-(n2^2);
y=sqrt(x);//numerical aperture
z=asind(y);//theta
printf("\nNA = sin(theta)in(max) = sqrt(n1^2-n2^2) =
    %.3f",y);
```

```
printf("\n(theta)in(max) = %.1f degrees",z);
```

Scilab code Exa 18.3 example3

```
//Fibre Optics : example 18-3 : pg(868)
w=22;//spectral width of LED
l=2;//length of fibre
d=95;//dispersion value
p=d*w;//pulse dispersion
pt=p*l;//total pulse dispersion
printf("\npulse dispersion = %.f ps/km",p);
printf("\ntotal pulse dispersion = pulse dispersion*
    length = %.f ps/km",pt);
```

Scilab code Exa 18.4 example4

```
//Fibre Optics : example 18-4 : pg(885)
d=30;//length of fibre cable
l=0.4;//loss
T=d*l;//total cable loss
printf("\ntotal cable loss = %.f dB",T);
```

Scilab code Exa 18.5 example5

```
//Fibre Optics : example 18-5 : pg(887)
b=565;//Line bit rate of fibre 1
c=3.5;//Cable dispersion of fibre 1
t=4;//Transmitter spectral width of fibre 1
b1=1130;//Line bit rate of fibre 2
c1=3.5;//Cable dispersion of fibre 2
```

```
t1=2;//Transmitter spectral width of fibre 2
x=440000;//assumed gaussian constant based on a 3-dB
    optical bandwidth using a FWHM pulse shape
L1=x/(b*c*t);//span length in km of fibre 1
L2=x/(b1*c1*t1);//span length in km of fibre 2
printf("\nL1 = %.1f km",L1);
printf("\nL2 = %.1f km",L2);
```