

Scilab Textbook Companion for
Basic Electronics
by R. D. S. Samuel, U. B. M. Swamy And V.
Nattarasu¹

Created by
Akash Linganagouda Patil
BE
Electronics Engineering
BVBCET,Hubli
College Teacher
Soumya Patil
Cross-Checked by

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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	4
1 PN Junction Diode	15
2 Semiconductor Diode Applications	35
3 pnp and npn Transistors	64
4 Other Devices	112
5 Amplifiers and Oscillators	124
6 Operational Amplifier	147
7 Communication System	159
8 Digital Logic	170

List of Scilab Codes

Exa 1.1.8	Find the forward and reverse resistance for diode	15
Exa 1.1.9	Find the forward and reverse resistance for diode	15
Exa 1.1.11	Find the forward and reverse resistance and cut in voltage for diode	16
Exa 1.1.20	Find the dynamic resistance	17
Exa 1.1.24	calculate current in circuit in fig 18	17
Exa 1.1.25	calculate diode current	18
Exa 1.1.26	calculate diode current across 2 diodes	18
Exa 1.1.27	find the forward current in circuit of fig 22	19
Exa 1.1.28	find out battery voltage	19
Exa 1.1.29	find out series resistance	20
Exa 1.1.31	Plot the piecewise linear characterisic of si diode	20
Exa 1.1.32	Plot the piecewiselinear characterisic of Germanium diode	21
Exa 1.1.34	find out diode current	22
Exa 1.1.35	find out series resistance in circuit fig 32	23
Exa 1.1.48	Find the maximum forward current at 25c	24
Exa 1.1.49	Find the maximum forward current at 25c and 80c and plot power temperature curve	24
Exa 1.1.50	Find maximum forward current at 80c	25
Exa 1.1.51	Find maximum forward current at 75c and draw power temperature curve	27
Exa 1.1.54	Find the forward voltage drop at 100c and dynamic resistance at 25c and 100c	28
Exa 1.1.55	Find the maximum and mini forward voltage drop and dynamic resistance	29
Exa 1.1.56	Find the max forward current and voltage and dynamic resistance	30
Exa 1.1.57	Find the diode currents at 25c and 100c	31

Exa 1.1.65	Find the minimal fall time	31
Exa 1.1.66	Estimate the maximum reverse recovery time	32
Exa 1.1.72	Find the maximum current flow through zener	32
Exa 1.1.75	Find the current through zener at 50c and 80c	33
Exa 1.1.76	Find the diode current and power dissipation	33
Exa 2.2.11	Calculate Peak ac dc load current dc diode voltage total input power percentage regulation of HW Rectifier . . .	35
Exa 2.2.12	Calculate DC RMS load voltage PIV across diode Recti- fication efficiency DC power delivered to load Frequency of output waveform of HW rectifier	36
Exa 2.2.20	Calculate peak RMS DC load current DC in each diode DC output voltage percentage regulation PIV RMS cur- rent DC load voltage of FW rectifier	37
Exa 2.2.21	Find the load current and rms value of input current of FW rectifier	38
Exa 2.2.22	Calculate Average load current and voltage and Ripple voltage of FW rectifier	39
Exa 2.2.23	Calculate Average voltage rectification efficiency and percentage regulation of FW rectifier	40
Exa 2.2.24	Calculate Average load voltage RMS load current PIV DC output power Frequency of output waveform	40
Exa 2.2.28	Calculate all characteristics of FW bridge rectifier . . .	41
Exa 2.2.29	Calculate Average output voltage avg load current fre- quency of output waveform dc power output of FWBR	43
Exa 2.2.34	Calculate Ripple factor DC output voltage DC load cur- rent PIV RMS output ripple voltage of HWR	43
Exa 2.2.35	Calculate the capacitance of HWR	44
Exa 2.2.40	Estimate the value of capacitor required to keep ripple factor less than 1per of FWR	45
Exa 2.2.41	Calculate minimum value of capacitance used in the fil- ter to keep ripple voltage below 2per of FWR	45
Exa 2.2.42	Find Ripple factor Dc output voltage Ripple voltage DC load current of FWR	46
Exa 2.2.43	Find the ripple factor and output voltage if a capacitor of 160uf is connected in parallel with load of FWR . . .	46
Exa 2.2.44	Find the ripple factor and DC load current of FWBR . .	47
Exa 2.2.45	Find the capacitor value for half wave rectifier	48
Exa 2.2.46	Find the capacitor value for full wave rectifier	48

Exa 2.2.50	calculate load and source effects and load and line regulation	49
Exa 2.2.51	calculate load and source effects and load and line regulation	49
Exa 2.2.54	Design the Zener Diode Voltage regulator for given specification	50
Exa 2.2.55	Design a zener diode voltage regulator to meet following specification	51
Exa 2.2.56	Design a zener diode voltage regulator to meet following specification	52
Exa 2.2.57	Calculate the value of series resistance and Zener diode current when load is 1200ohm	53
Exa 2.2.58	Design a voltage regulator using zener diode to meet following specification	54
Exa 2.2.59	Design a zener voltage regulator to meet following specification	55
Exa 2.2.60	Design a zener voltage regulator to meet following specification	56
Exa 2.2.61	Design a zener voltage regulator to meet following specification	57
Exa 2.2.63	Design a 6V dc reference source to operate from a 16v supply	58
Exa 2.2.64	Design a 8V dc reference source to operate from a 20v supply and find maximum load current	59
Exa 2.2.65	Calculate circuit current when supply voltage drops to 27V select suitable components	60
Exa 2.2.66	Calculate the effect of a 10per variation supply voltage on diode current	61
Exa 2.2.68	Calculate the line regulation output resistance load regulation and ripple rejection ratio	62
Exa 3.3.14	calculate the value of I_c I_e beta for a transistor	64
Exa 3.3.15	Find the value of alpha and beta of transistor and I_b for desired I_c	65
Exa 3.3.16	calculate the value of alpha beta and I_b for a transistor	65
Exa 3.3.17	calculate the value of beta for transistor and find new collector current when beta of new transistor is 70	66
Exa 3.3.18	calculate the value of I_c I_e for a transistor and Find beta for transistor	67

Exa 3.3.19	calculate the value of I_e alpha beta for a transistor and find I_b for new value of I_c	67
Exa 3.3.20	calculate the value of I_c and I_e for a transistor	68
Exa 3.3.21	calculate the value of I_c alpha beta for a transistor and I_c when I_b is 150uA	69
Exa 3.3.22	calculate the value of I_b beta for a transistor and I_c I_e for new value of beta	69
Exa 3.3.25	Find the DC collector voltage and voltage gain of ckt for V_i is 50mV	70
Exa 3.3.26	Find the DC current gain for circuit fig 15 and ac voltage gain	71
Exa 3.3.27	Find the parameters of the ckt of question 27	72
Exa 3.3.34	Obtain the CB current gain and output characteristics	73
Exa 3.3.46	For the circuit given draw a DC load line	75
Exa 3.3.50	Draw a DC load line for the base bias circuit	77
Exa 3.3.51	Draw a DC load line for the base bias circuit for different hFE	79
Exa 3.3.52	Find I_c and V_{ce} and Draw a DC load line for the base bias circuit	80
Exa 3.3.53	Find I_c and V_{ce} and Draw a DC load line for the base bias circuit	81
Exa 3.3.54	Draw a DC load line for the base bias circuit neglecting V_{be}	83
Exa 3.3.55	Calculate transistor hFE and new V_{ce} level for hFE is 100 of base bias circuit	85
Exa 3.3.57	Design a Base bias circuit	87
Exa 3.3.58	Draw the DC load line and determine R_c for base bias circuit	88
Exa 3.3.59	Calculate Base resistance for base bias circuit	88
Exa 3.3.61	Determine the I_c and V_{ce} levels and draw DC load line for Collector to base bias	90
Exa 3.3.62	Determine the hFE and new V_{ce} for hFE is 50 for Collector to base bias	91
Exa 3.3.63	Draw a DC load line for Collector to base bias	93
Exa 3.3.64	Draw a DC load line for Collector to base bias for different hFE	94
Exa 3.3.66	Design a Collector to base bias circuit	95
Exa 3.3.67	Design a Collector to base bias circuit	97

Exa 3.3.68 Calculate required base resistance for Collector to base bias circuit	98
Exa 3.3.72 Draw a DC load line for Voltage divider circuit	98
Exa 3.3.73 Find the V_e I_c V_{ce} and V_c and Draw a DC load line for Voltage divider circuit	101
Exa 3.3.74 Find the V_e I_c V_{ce} and V_c and Draw a DC load line for Voltage divider circuit	102
Exa 3.3.76 Design a Voltage divider bias circuit	104
Exa 3.3.77 Design a Voltage divider bias circuit	105
Exa 3.3.79 Calculate the suitable resistor values for Voltage divider bias circuit	106
Exa 3.3.85 Find the stability factor and change in I_c for increase in temperature of base bias circuit	107
Exa 3.3.86 Find the stability factor and change in I_c for increase in temperature of collector to base bias circuit	108
Exa 3.3.87 Find the stability factor and change in I_c for increase in temperature of Voltage divider bias circuit	109
Exa 3.3.89 Calculate the change in I_c produced by effect of V_{be} changes over temperature of Voltage divider bias circuit	110
Exa 3.3.90 Calculate the change in I_c produced by effect of V_{be} changes over temperature of Voltage divider bias circuit	111
Exa 4.4.18 Calculate input voltage that turns SCR ON and supply voltage that turns OFF	112
Exa 4.4.28 Calculate the values of R_1 R_2 and R_p of SCR circuit .	113
Exa 4.4.29 Calculate the values of R_1 R_2 and R_p of SCR circuit .	114
Exa 4.4.40 Design the SCR crowbar circuit to protect the load from voltage levels greater than 12V	115
Exa 4.4.41 Design the SCR crowbar circuit to protect the load from voltage levels greater than specified voltage	116
Exa 4.4.49 Determine the minimum and maximum triggering voltage for a UJT	117
Exa 4.4.51 find maximum oscillating frequency of UJT	117
Exa 4.4.52 Determine the minimum and maximum values of V_{EB1} for a UJT	118
Exa 4.4.53 find maximum oscillating frequency of UJT	119
Exa 4.4.74 plot the drain characteristics of JFET	119
Exa 4.4.77 calculate V_{ds} at these gate source voltages and circuit voltage gain of JFET	121

Exa 4.4.78	calculate the minimum and maximum variation in V_{ds} and circuit voltage gain of JFET	121
Exa 4.4.79	calculate transconductance of JFET	122
Exa 4.4.80	determine the suitable value of load resistor R_d of JFET	123
Exa 5.5.3	Calculate output power change in decibel of amplifier .	124
Exa 5.5.4	Calculate output power change in decibel of amplifier .	124
Exa 5.5.5	Calculate power gain of amplifier	125
Exa 5.5.6	Calculate new level of output voltage when it has fallen by 4db	125
Exa 5.5.10	Calculate overall voltage gain and output voltage when input voltage is 1uV for cascaded amplifier	126
Exa 5.5.11	Calculate overall voltage gain in db of cascaded 2 stage amplifier	127
Exa 5.5.12	Calculate overall voltage gain and gain of 2nd and 3rd stage and input voltage of 2nd stage	127
Exa 5.5.15	For CE amplifier find R_1 R_2 R_e and R_c	128
Exa 5.5.16	For CE amplifier find R_1 R_2 R_e and R_c	129
Exa 5.5.19	calculate upper cutoff frequency and voltage gain at lower cutoff frequency	130
Exa 5.5.23	calculate closed loop gain for the negative feedback amplifier	131
Exa 5.5.24	calculate closed loop gain for the negative feedback amplifier	131
Exa 5.5.27	calculate input impedance of amplifier with negative feedback	132
Exa 5.5.29	calculate input and output impedance of amplifier with negative feedback	133
Exa 5.5.35	Estimate the closed loop upper cut off frequency and total harmonic distortion	134
Exa 5.5.36	calculate open loop cut off frequency if the open loop gain is 200000	135
Exa 5.5.37	calculate the phase shift with negative feedback	135
Exa 5.5.38	calculate bandwidth and gain and harmonic distortion with feedback	136
Exa 5.5.40	calculate the frequency of oscillation and feedback factor of Hartley oscillator	137
Exa 5.5.43	calculate the frequency of oscillation of RC phase shift oscillator	137

Exa 5.5.44	calculate the value of Capacitor for a RC phase shift oscillator	138
Exa 5.5.45	calculate the value of R and C for RC phase shift oscillator	138
Exa 5.5.49	calculate frequency of oscillation and feedback factor and gain of hartley oscillator	139
Exa 5.5.51	calculate the value of L1 and L2 of Hartley oscillator .	140
Exa 5.5.53	Design the value of L1 L2 and C for a hartley oscillator	140
Exa 5.5.55	calculate the frequency of oscillation of Colpitts oscillator	141
Exa 5.5.56	calculate the frequency of oscillation feedback factor and gain required for sustained oscillation	142
Exa 5.5.57	calculate the value of L of Colpitts oscillator	142
Exa 5.5.58	calculate the value of C1 and C2 of Colpitts oscillator	143
Exa 5.5.59	calculate the value of L and C for a colpitts oscillator .	144
Exa 5.5.61	calculate the frequency of oscillation for Wein Bridge Oscillator	144
Exa 5.5.62	calculate the value of R and C for Wein Bridge oscillator	145
Exa 5.5.65	calculate the Series and parallel resonant frequencies of Crystal	145
Exa 6.6.15	Calculate maximum frequency at which output is faithful reproduction of input	147
Exa 6.6.19	Calculate common mode output voltage	147
Exa 6.6.20	Express CMRR in dB	148
Exa 6.6.24	Calculate and sketch the output	150
Exa 6.6.25	Calculate design value of inverting amplifier	150
Exa 6.6.26	Calculate output voltage of inverting amplifier	151
Exa 6.6.27	Calculate closed loop gain and input voltage for a specified output voltage	151
Exa 6.6.28	Calculate feedback resistor and closed loop gain	152
Exa 6.6.31	Calculate output voltage for given input voltage of non inverting amplifier	153
Exa 6.6.32	Calculate closed loop gain and input voltage for a specified output voltage of noninverting amplifier	153
Exa 6.6.33	Calculate output voltage for inverting amplifier	154
Exa 6.6.34	Calculate output voltage for non inverting amplifier	155
Exa 6.6.37	Calculate closed loop gain and current	156
Exa 6.6.45	Calculate output voltage for summer	156
Exa 6.6.55	Calculate bandwidth	157

Exa 6.6.56 Calculate the design value of amplifier circuit	157
Exa 6.6.57 Calculate design value of circuit	158
Exa 7.7.25 Determine sideband frequencies and Bandwidth	159
Exa 7.7.27 Calculate total power in modulated wave	159
Exa 7.7.28 Determine radiated power	160
Exa 7.7.34 Calculate carrier power	160
Exa 7.7.35 Determine power content of carrier and sidebands	161
Exa 7.7.36 Calculate sideband frequencies and bandwidth and total power	161
Exa 7.7.37 Calculate modulation index	162
Exa 7.7.38 Determine antenna current	163
Exa 7.7.39 Calculate transmission power efficiency and average power in carrier component	163
Exa 7.7.40 Calculate modulation index	164
Exa 7.7.41 Sketch the frequency spectrum	164
Exa 7.7.42 Find the saving power in LSB alone	166
Exa 7.7.55 Find maximum frequency deviation and modulation in- dex	167
Exa 7.7.56 Calculate frequency deviation and modulation index	167
Exa 7.7.92 Find the peak value of unknown voltage	168
Exa 8.8.7 Convert the binary number to decimal without decimal point	170
Exa 8.8.8 Convert the binary number to decimal with decimal point	171
Exa 8.8.10 convert the decimal to binary numbers	173
Exa 8.8.12 convert the octal to decimal	174
Exa 8.8.13 convert the decimael numbers to Octal	177
Exa 8.8.14 convert the binary number to Octal	178
Exa 8.8.15 convert the octal to binary number	182
Exa 8.8.17 convert the hexadecimael numbers to decimal	185
Exa 8.8.18 convert the decimael numbers to hexadecimal	186
Exa 8.8.19 convert the binary numbers to hexadecimal	186
Exa 8.8.21 Add the binary numbers	187
Exa 8.8.23 Add the octal numbers	192
Exa 8.8.25 Add the hexadecimal numbers	197
Exa 8.8.30aperform the decimal subtraction using 9s complements	198
Exa 8.8.30bperform the decimal subtraction using 10s complements	199
Exa 8.8.31aperform the binary subtraction using 1s complement	200
Exa 8.8.31bperform the binary subtraction using 2s complement	201

Exa 8.8.48a	Prove the boolean theorem	203
Exa 8.8.48b	Prove the boolean theorem	204
Exa 8.8.49a	Prove the boolean identities	205
Exa 8.8.49b	Prove the boolean identities	206
Exa 8.8.50a	Construct the Truth Table for logic expression	207
Exa 8.8.50b	Construct the Truth Table for logic expression	208
Exa 8.8.50c	Construct the Truth Table for logic expression	209

List of Figures

1.1	Plot the piecewise linear characterisic of si diode	21
1.2	Plot the piecewiselinear characterisic of Germanium diode	22
1.3	Find the maximum forward current at 25c and 80c and plot power temperature curve	26
1.4	Find maximum forward current at 75c and draw power temperature curve	28
3.1	Obtain the CB current gain and output characteristics	74
3.2	For the circuit given draw a DC load line	76
3.3	Draw a DC load line for the base bias circuit	78
3.4	Draw a DC load line for the base bias circuit for different hFE	80
3.5	Find Ic and Vce and Draw a DC load line for the base bias circuit	82
3.6	Find Ic and Vce and Draw a DC load line for the base bias circuit	84
3.7	Draw a DC load line for the base bias circuit neglecting Vbe	86
3.8	Draw the DC load line and determine Rc for base bias circuit	89
3.9	Determine the Ic and Vce levels and draw DC load line for Collector to base bias	92
3.10	Draw a DC load line for Collector to base bias	94
3.11	Draw a DC load line for Collector to base bias for different hFE	96
3.12	Draw a DC load line for Voltage divider circuit	100
3.13	Find the Ve Ic Vce and Vc and Draw a DC load line for Voltage divider circuit	102
3.14	Find the Ve Ic Vce and Vc and Draw a DC load line for Voltage divider circuit	104
4.1	plot the drain characteristics of JFET	120

6.1	Calculate and sketch the output	149
7.1	Sketch the frequency spectrum	165

Chapter 1

PN Junction Diode

Scilab code Exa 1.1.8 Find the forward and reverse resistance for diode

```
1 clc
2 disp("Example 1.8")
3 printf("\n")
4 disp("find out resistance")
5 printf("Given\n")
6 disp("forward current=100mA, Vr=25V, cut in voltage
    =0.7v, reverse current=100nA")
7 //all the values are from fig 1.8
8 Vf=0.7
9 If=100*10^-3 //forward current
10 Vr=25
11 Ir=100*10^-9 //reverse current
12 Rf=Vf/If
13 Rr=Vr/Ir
14 printf("static forward resistance=\n%f ohm\n",Rf)
15 printf("static reverse resistance=\n%f ohm\n",Rr)
```

Scilab code Exa 1.1.9 Find the forward and reverse resistance for diode


```

1  clc
2  disp(" Example 1.9")
3  printf("\n")
4  disp(" find out resistance")
5  printf(" Given\n")
6  disp(" forward current=200mA, Vr=75V, cut in voltage
       =0.75v, reverse current=50nA")
7  //all values are from fig 1.9
8  Vf=0.75
9  If=200*10^-3 //forward current
10 Vr=75
11 Ir=50*10^-9 //reverse current
12 Rf=Vf/If
13 Rr=Vr/Ir
14 printf(" static forward resistance=\n%f ohm\n",Rf)
15 printf(" static reverse resistance=\n%f ohm\n",Rr)

```

Scilab code Exa 1.1.11 Find the forward and reverse resistance and cut in voltage for diode

```

1  clc
2  disp(" Example 1.11")
3  printf("\n")
4  disp(" findout resistance and cut in voltage")
5  printf(" Given\n")
6  disp(" forward current=100mA, Vr=25V, cut in voltage
       =0.7v, reverse current=100nA")
7  //all the values are from fig 1.10
8  Vf=0.35
9  If=80*10^-3 //forward current
10 Vr=40
11 Ir=10^-6 //reverse current
12 Rf=Vf/If
13 Rr=Vr/Ir
14 printf(" static forward resistance=\n%f ohm\n",Rf)

```

```

15 printf("static reverse resistance=\n%f ohm\n",Rr)
16 //from the characteristic curve we can find cut in
    voltage
17 printf("cut in voltage= 0.3V")

```

Scilab code Exa 1.1.20 Find the dynamic resistance

```

1  clc
2  disp(" Example 1.20")
3  printf("\n")
4  disp(" calculate dynamic and substrate resistance")
5  printf(" Given\n")
6  disp(" forward current=20mA, cut in voltage=0.33v")
7  If=20*10^-3
8  Vf=0.33
9  Rf=Vf/If
10 If1=If-(10^-2) //min forward current
11 If2=If+(10^-2) //max forward current
12 Vf1=0.31
13 Vf2=0.35
14 rd=(Vf2-Vf1)/(If2-If1)
15 rd1=0.026/If
16 rsub=rd-rd1
17 printf("static forward resistance=\n%f ohm\n",Rf)
18 printf("Dynamic resistance=\n%f ohm\n",rd)
19 printf("Dynamic resistance using forward current=\n
    n%f ohm\n",rd1)
20 printf("substrate resistance=\n%f ohm\n",rsub)

```

Scilab code Exa 1.1.24 calculate current in circuit in fig 18

```

1  clc
2  disp(" Example 1.24")

```

```

3 printf("\n")
4 disp("calculate the current in the circuit in fig
      1.18")
5 //given
6 V=12
7 R1=10^3
8 R2=2*10^3
9 //current
10 I=V/(R1+R2)
11 printf("current in the circuit=%f Ampere",I)

```

Scilab code Exa 1.1.25 calculate diode current

```

1 clc
2 disp("Example 1.25")
3 printf("\n")
4 disp("calculate the diode current")
5 //given
6 V=12
7 R=10^3
8 Vd=0.7
9 //diode current
10 I=(V-Vd)/R
11 printf("Diode current=%f Ampere",I)

```

Scilab code Exa 1.1.26 calculate diode current across 2 diodes

```

1 clc
2 disp("Example 1.26")
3 printf("\n")
4 disp("calculate the diode current across 2 diodes")
5 //given
6 V=12

```

```

7 Vd1=0.7
8 Vd2=0.7
9 R=10^3
10 //current
11 I=(V-(Vd1+Vd2))/R
12 printf("Diode current =%f Ampere",I)

```

Scilab code Exa 1.1.27 find the forward current in circuit of fig 22

```

1 clc
2 disp("Example 1.27")
3 printf("\n")
4 disp("find the forward current in circuit of fig
      1.22")
5 //given
6 V=9
7 Vd=0.3
8 R=3.3*10^3
9 //current
10 I=(V-Vd)/R
11 printf("forward current=%f Ampere",I)

```

Scilab code Exa 1.1.28 find out battery voltage

```

1 clc
2 disp("Example 1.28")
3 printf("\n")
4 disp("find out battery voltage")
5 //given
6 R=2.7*10^3
7 Vd=0.7
8 I=1.96*10^-3
9 //battery voltage

```

```
10 V=(I*R)+Vd
11 printf("battery voltage=%f volt",V)
```

Scilab code Exa 1.1.29 find out series resistance

```
1 clc
2 disp("Example 1.29")
3 printf("\n")
4 disp("find out series resistance")
5 //given
6 V=4.5
7 Vd=0.3
8 I=1.25*10^-3
9 //series resistance
10 R=(V-Vd)/I
11 printf("series resistance=%f ohm",R)
```

Scilab code Exa 1.1.31 Plot the piecewise linear characteristic of si diode

```
1 clc
2 disp("Example 1.31")
3 printf("\n")
4 disp("Plot the piecewise-linear characteristic of
      silicon diode")
5 printf("Given\n")
6 //given
7 Vf=[0 0.7 0.74]
8 If=[0 0 0.2]
9 plot2d(Vf, If)
10 xlabel("Vf")
11 ylabel("If")
12 xtitle("Piecewise-linear characteristic of diode")
```

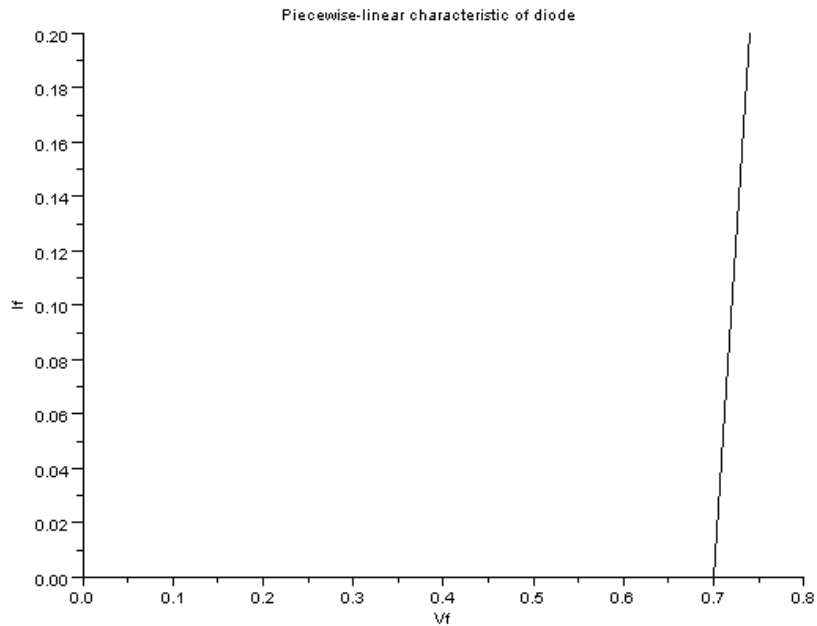


Figure 1.1: Plot the piecewise linear characteristic of si diode

Scilab code Exa 1.1.32 Plot the piecewiselinear characteristic of Germanium diode

```

1 clc
2 disp(" Example 1.32")
3 printf(" \n")
4 disp(" Plot the piecewise-linear characteristic of
      Germanium diode")
5 printf(" Given \n")
6 //given

```

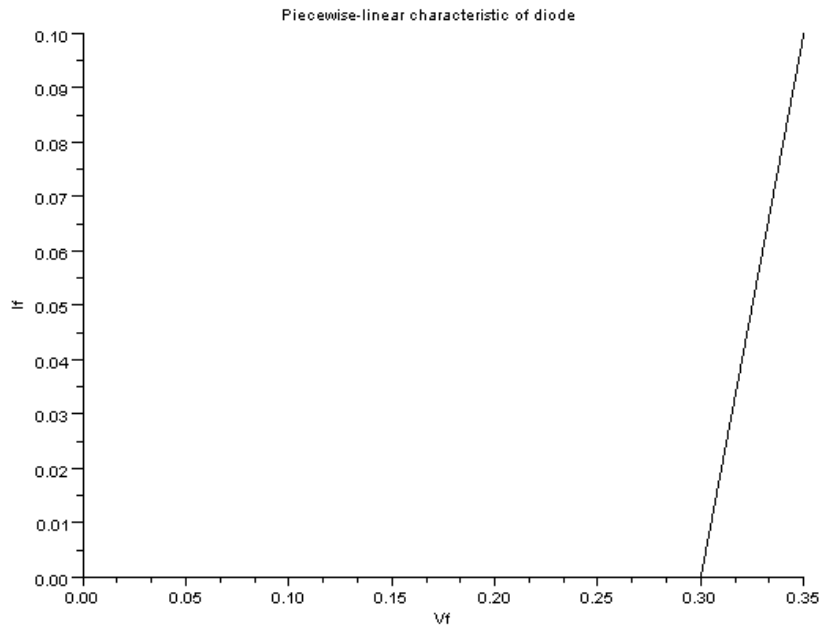


Figure 1.2: Plot the piecewiselinear characterisic of Germanium diode

```

7 Vf=[0 0.3 0.35]
8 If=[0 0 0.1]
9 plot2d(Vf, If)
10 xlabel("Vf")
11 ylabel("If")
12 xtitle("Piecewise-linear characteristic of diode")

```

Scilab code Exa 1.1.34 find out diode current

```

1 clc
2 disp(" Example 1.34")

```

```

3 printf("\n")
4 disp("find out diode current")
5 //given
6 V=2
7 Vr=0.6
8 rd1=0
9 rd2=0.2
10 R=14
11 //when rd=0
12 //diode current
13 I1=(V-Vr)/R
14 printf("Diode current when rd=0 is \n%f ampere\n",I1
    )
15 //when rd=0.2
16 //diode current
17 I2=(V-Vr)/(R+rd2)
18 printf("Diode current when rd=0.2 is \n%f ampere\n",
    I2)

```

Scilab code Exa 1.1.35 find out series resistance in circuit fig 32

```

1 clc
2 disp("Example 1.35")
3 printf("\n")
4 disp("find out series resistance in circuit fig 1.32
    ")
5 V=3
6 rd=0.5
7 Vr=0.3
8 IF=174*10^-3
9 //resistance
10 R=(V-Vr-(IF*rd))/IF
11 printf("The value of resistance is \n%f ohm\n",R)

```

Scilab code Exa 1.1.48 Find the maximum forward current at 25c

```
1  clc
2  disp(" Example 1.48")
3  printf("\n")
4  disp(" Find the maximum forward current")
5  T1=25          //to find maximum forward current at
   this temperature
6  T2=65          //to find maximum forward current at
   this temperature
7  PT1=600*10^-3 //maximum power dissipation at 25c
8  D=5*10^-3     //derating factor
9  VT1=0.6       //forward voltage drop(constant at
   all temperature)
10 VT2=VT1
11 IT1=PT1/VT1   //maximum forward current at T1
12 PT2=PT1-((T2-T1)*D)
13 IT2=PT2/VT2   //maximum forward current at T2
14 printf("Forward current at temperature T1=\n%f
   Ampere\n", IT1)
15 printf("Forward current at temperature T2=\n%f
   Ampere\n", IT2)
```

Scilab code Exa 1.1.49 Find the maximum forward current at 25c and 80c and plot power temperature curve

```
1  clc
2  disp(" Example 1.49")
3  printf("\n")
4  disp(" find the maximum forward current at 25c and 80
   c")
5  printf(" Given\n")
```

```

6 T1=25          //to find maximum forward current
  at this temperature
7 T2=80          //to find maximum forward current
  at this temperature
8 VT1=0.65       //forward voltage drop(constant at
  all temperature)
9 VT2=VT1
10 PT1=80*10^-3  //maximum power dissipation at 80c
11 PT2=30*10^-3  //maximum power dissipation at 30c
12 IT1=PT1/VT1
13 IT2=PT2/VT2
14 T=[0 25 80 114]
15 P=[80 80 30 0]
16 plot2d(T,P)
17 xlabel("Temperature in c")
18 ylabel("Power in mW")
19 xtitle("Power-Temperature curve")
20 printf("Forward current at T1=\n%f Ampere\n",IT1)
21 printf("Forward current at T2=\n%f Ampere\n",IT2)

```

Scilab code Exa 1.1.50 Find maximum forward current at 80c

```

1 clc
2 disp("Example 1.50")
3 printf("\n")
4 disp("Find the maximum power at 80c")
5 T1=25
6 PT1=1000*10^-3 //maximum power dissipation at 25c
7 T2=80
8 D=4*10^-3      //derating factor
9 PT2=PT1-((T2-T1)*D) //maximum power dissipation at
  80c
10 printf("Maximum Power dissipated at 80c=\n%f watt\n")

```

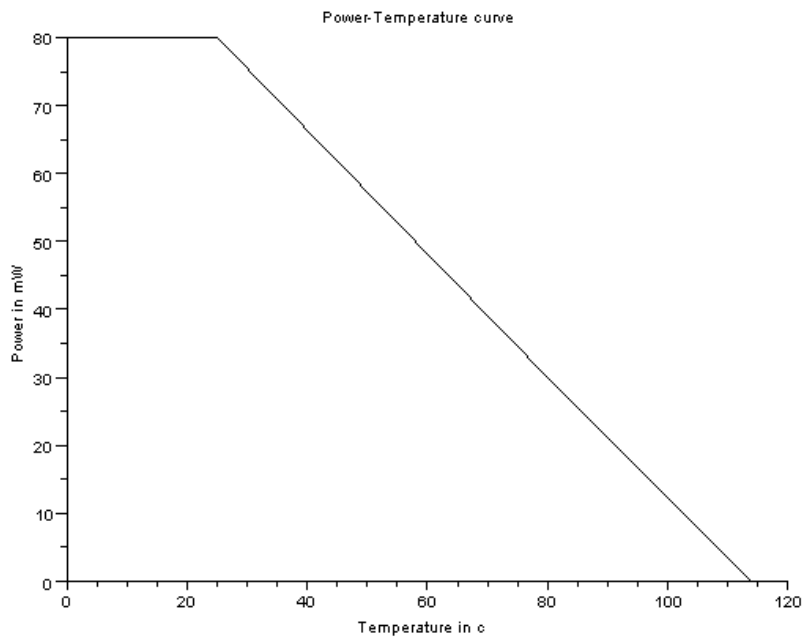


Figure 1.3: Find the maximum forward current at 25c and 80c and plot power temperature curve

,PT2)

Scilab code Exa 1.1.51 Find maximum forward current at 75c and draw power temperature curve

```
1  clc
2  disp("Example 1.51")
3  printf("\n")
4  disp("Find the maximum forward current and Draw
      power spectrum curve")
5  printf("Given\n")
6  T1=25
7  PT1=1000*10^-3    //maximum power dissipation at 25c
8  //Average current
9  IT1=500*10^-3
10 IT2=IT1
11 VT2=0.8           //forward voltage drop
12 D=10^-2
13 PT2=VT2*IT2
14 T2=((PT1-PT2)/D)+T1
15 //to caculate maximum forward current at 75c
16 T2!=75
17 PT2!=PT1-((T2!-T1)*D)
18 IT2=PT2!/VT2
19 //for(T>25), to draw graph
20   vd=10^-2
21   PT=(1000-(75*10))*10^-3 //maximum power
      dissipation at 100c
22 Temp=[0 25 100 125]
23 p=[1000 1000 PT*10^3 0]
24 plot2d(Temp ,p)
25 xlabel("Temperature in c")
26 ylabel("Power in mW")
27 xtitle("Power-Temperature Curve")
28 printf("Maximum forward current at 75c=\n%f Ampere\n
```

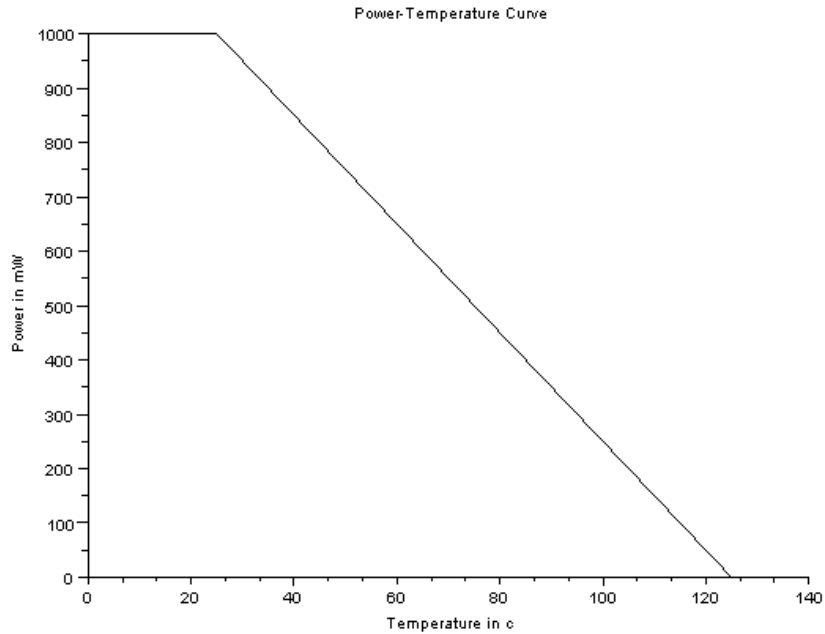


Figure 1.4: Find maximum forward current at 75c and draw power temperature curve

” ,IT2)

Scilab code Exa 1.1.54 Find the forward voltage drop at 100c and dynamic resistance at 25c and 100c

```

1 clc
2 disp("Example 1.54")
3 printf("\n")
4 disp("Find the forward voltage drop at 100c and
dynamic resistance")

```

```

5 T1=25
6 T2=100
7 Vft1=0.6 //forward voltage drop at 25c
8 IT1=26*10^-3 //forward current(constant)
9 IT2=IT1
10 //for silicon diode we know that
11 v=(-1.8*10^-3)
12 Vft2=Vft1+((T2-T1)*v)
13 IF=26*10^-3
14 rd1=(26*10^-3/IF)*((T1+273)/298)
15 rd2=(26*10^-3/IF)*((T2+273)/298)
16 printf("Forward voltage drop at 100c=\n%f volt\n",
        Vft2)
17 printf("Dynamic resistance at 25c and 100c=\n%f ohm\
        n%f ohm\n",rd1,rd2)

```

Scilab code Exa 1.1.55 Find the maximum and mini forward voltage drop and dynamic resistance

```

1 clc
2 disp("Example 1.55")
3 printf("\n")
4 disp("Calculate maximum & minimum forward voltage
        drop and Junction dynamic resistance")
5 T1=80
6 T2=10
7 T=25
8 //for germanium diode
9 v=(-2.2*10^-3)
10 Vft1=0.3
11 Vft2maximum=Vft1+((T2-T)*v) //voltage drop at 10c
12 Vft2minimum=Vft1+((T1-T)*v) //voltage drop at 80c
13 IF=20*10^-3
14 rd1=(26*10^-3/IF)*((T2+273)/298)
15 rd2=(26*10^-3/IF)*((T1+273)/298)

```

```

16 printf("Maximum and Minimum Forward voltage drop at
    25c and 10c=\n%f volt\n%f volt\n",Vft2maximum,
    Vft2minimum)
17 printf("Dynamic resistance at 10c and 80c=\n%f ohm\
    n%f ohm\n",rd1,rd2)

```

Scilab code Exa 1.1.56 Find the max forward current and voltage and dynamic resistance

```

1  clc
2  disp("Example 1.56")
3  printf("\n")
4  disp("To find maximum forward current at 25c & 75c
    and Forward voltage drop and Dynamic resistance")
5  PT1=1.5
6  VT1=0.9
7  D=7.5*10^-3
8  //for silicon diodes
9  v=(-1.8*10^-3)
10 IF=20*10^-3
11 T1=25
12 T2=75
13 IT1=PT1/VT1
14 PT2=PT1-((T2-T1)*D)
15 IT2=PT2/VT1 //assume voltage drop remains constant
    at all temperature
16 VF2=VT1+((T2-T1)*v)
17 rd1=(26*10^-3/IF)*((T1+273)/298)
18 rd2=(26*10^-3/IF)*((T2+273)/298)
19 printf("Maximum forward current at 25c & 75c =\n%f
    Ampere\n%f Ampere\n",IT1,IT2)
20 printf("Forward voltage drop at 75c=\n%f volt\n",VF2
    )
21 printf("Dynamic resistance at 25c and 75c=\n%f ohm\
    n%f ohm\n",rd1,rd2)

```

Scilab code Exa 1.1.57 Find the diode currents at 25c and 100c

```
1 clc
2 disp("Example 1.57")
3 printf("\n")
4 disp("To find diode current at 25c and 75c")
5 RL=150
6 //both diode voltage drop as given in fig 1.47
7 Vr1=0.7 //for silicon
8 Vr2=0.3 //for Germanium
9 Vdc=5
10 //apply KVL to given circuit
11 IF1=(Vdc-(Vr1+Vr2))/RL
12 //for silicon diode
13 v=(-1.8*10^-3)
14 T1=25
15 T2=75
16 VFT2=Vr1+((T2-T1)*v)
17 //for Germanium Diode
18 v=(-2.2*10^-3)
19 VFT2!=Vr2+((T2-T1)*v)
20 IF2=(Vdc-(VFT2!+VFT2))/RL
21 printf("Diode current at 25c and 75c =\n%f ampere\
    \n%f ampere\n", IF1, IF2)
```

Scilab code Exa 1.1.65 Find the minimal fall time

```
1 clc
2 disp("Example 1.65")
3 printf("\n")
4 disp("Find the minimal fall-time")
```



```

5 //reverse-recovery time is
6 trr=4*10^-9
7 tfmin=10*trr
8 printf("The minimal fall-time for voltage pulses
        applied=\n%3.2e sec\n",tfmin)

```

Scilab code Exa 1.1.66 Estimate the maximum reverse recovery time

```

1 clc
2 disp("Example 1.66")
3 printf("\n")
4 disp("Find the maximum recovery time")
5 //fall-time is
6 tf=0.5*10^-6
7 trrmax=tf/10
8 printf("The minimal fall-time for voltage pulses
        applied=\n%3.2e sec\n",trrmax)

```

Scilab code Exa 1.1.72 Find the maximum current flow through zener

```

1 clc
2 disp("Example 1.72")
3 printf("\n")
4 disp("Find the maximum current flow through Zener
        diode")
5 Vz=7.5 //zener voltage
6 Pd1=400*10^-3 //maximum power dissipation at 50c
7 T1=50
8 T2=100
9 D=3.2*10^-3
10 //current at 50c
11 Izm1=Pd1/Vz
12 //current at 100

```

```

13 Pd2=Pd1-((T2-T1)*D)
14 Izm2=Pd2/Vz
15 printf("maximum current flow through Zener diode at
    50c & 100c=\n%f Ampere\n%f Ampere\n",Izm1 ,Izm2)

```

Scilab code Exa 1.1.75 Find the current through zener at 50c and 80c

```

1  clc
2  disp(" Example 1.75")
3  printf("\n")
4  disp(" Find the current through diode at 50c & 80c")
5  T1=50
6  T2=80
7  D=3.2*10^-3
8  Pd1=400*10^-3
9  Vz=6.2
10 //at 50c
11 Izm1=Pd1/Vz
12 //at 80c
13 Pd2=Pd1-((T2-T1)*D)
14 Izm2=Pd2/Vz
15 printf("the current through diode at 50c & 80c=\n%f
    ampere\n%f ampere\n",Izm1 ,Izm2)

```

Scilab code Exa 1.1.76 Find the diode current and power dissipation

```

1  clc
2  disp(" Example 1.76")
3  printf("\n")
4  disp(" Find the diode current and power dissipation")
5  Vdc=12
6  Vz=4.3 //zener voltage
7  R=820

```

```
8 Iz=(Vdc-Vz)/R
9 Pd=Vz*Iz
10 printf("the diode current=\n%f ampere\n",Iz)
11 printf("the power dissipation=\n%f watt\n",Pd)
```

Chapter 2

Semiconductor Diode Applications

Scilab code Exa 2.2.11 Calculate Peak ac dc load current dc diode voltage total input power percentage regulation of HW Rectifier

```
1 clc
2 disp(" Example 2.11 ")
3 printf("\n")
4 disp(" Calculate Peak ,ac ,dc load current ,dc diode
      voltage ,total input power ,percentage regulation
      of HW Rectifier ")
5 printf(" Given \n ")
6 Rf=20
7 RL=1000
8 N1=1
9 N2=N1
10 V1=110
11 V2=V1 //since (V1/V2)=(N1/N2)
12 Vm=sqrt(2)*V2
13 Im=Vm/(Rf+RL) //peak load current
14 Idc=Im/%pi //DC load current
15 Irms=Im/2 //AC load current
16 V!dc=-Idc*RL //DC diode Voltage
```

```

17 Pi=(Irms)^2*(Rf+RL) //Total power input to
    circuit
18 %reg=(Rf/RL)*100 //percentage regulation
19 printf("Peak,DC,AC load current are =\n%f ampere\n%f
    ampere\n%f ampere\n",Im,Idc,Irms)
20 printf("DC Diode voltage =\n%f volt\n",V!dc)
21 printf("Total power input to circuit =\n%f watt\n",
    Pi)
22 printf("percentage regulation =\n%f\n",%reg)

```

Scilab code Exa 2.2.12 Calculate DC RMS load voltage PIV across diode
 Rectification efficiency DC power delivered to load Frequency of output wave-
 form of HW rectifier

```

1 clc
2 disp(" Example 2.12")
3 printf("\n")
4 disp(" Calculate DC,RMS load voltage ,PIV across diode
    , Rectification efficiency ,DC power delivered to
    load ,Frequency of output waveform ")
5 printf(" Given\n")
6 Rf=50
7 RL=500
8 N1=10
9 N2=1
10 V1=230
11 Vm=(N2/N1)*V1
12 w=314
13 f=w/(2*%pi)
14 Vdc=(Vm/%pi)/(1+(Rf/RL)) //DC load voltage
15 Vrms=(Vm/2)/(1+(Rf/RL)) //RMS load voltage
16 PIV=Vm
17 %n=40.6/(1+(Rf/RL)) //Rectification
    efficiency
18 Pdc=(Vdc^2)/RL

```

```

19 printf("DC,RMS load voltage=\n%f volt\n%f volt\n",
        Vdc,Vrms)
20 printf("PIV across the diode =\n%f volt\n",PIV)
21 printf("Rectification efficiency=\n%f\n",%n)
22 printf("DC power delivered to a load=\n%f watt\n",
        Pdc)

```

Scilab code Exa 2.2.20 Calculate peak RMS DC load current DC in each diode DC output voltage percentage regulation PIV RMS current DC load voltage of FW rectifier

```

1  clc
2  disp(" Example 2.20")
3  printf("\n")
4  disp(" Calculate peak ,RMS,DC load current , DC in each
        diode ,DC output voltage ,% regulation ,PIV ,RMS
        current ,DC load voltage")
5  printf(" Given\n")
6  Rf=500
7  RL=2000
8  V2=280
9  //Secondary voltage is
10 Vm=sqrt(2)*V2
11 //Peak load current
12 Im=Vm/(Rf+RL)
13 //DC load current
14 Idc=2*Im/(%pi)
15 //Since each diode acts as a half-wave rectifier ,the
        dc current through each diode is
16 Idc1=Im/(%pi)
17 //dc output power
18 Pdc=[Idc]^2*RL
19 %reg=(Rf/RL)*100
20 //PIV across each diode
21 PIV=2*Vm

```

```

22 //RMS load current
23 Irms=Im/(sqrt(2))
24 //RMS through each diode is
25 Irms1=(Im/2)
26 //Dc load voltage
27 Vdc=Idc*RL
28 printf("peak load , DC load current is \n%f ampere\
        n%f ampere\n",Im,Idc)
29 printf("direct current in each diode is \n%f ampere\
        n",Idc1)
30 printf("dc output power is \n%f watt\n",Pdc)
31 printf("percentage regulation is \n%f\n",%reg)
32 printf("PIV across each diode is \n%f volt\n",PIV)
33 printf("rms load current and rms current through
        each diode is\n%f ampere\n%f ampere \n",Irms,
        Irms1)
34 printf("DC load voltage is \n%f volt\n",Vdc)

```

Scilab code Exa 2.2.21 Find the load current and rms value of input current of FW rectifier

```

1 clc
2 disp(" Example 2.21 ")
3 printf("\n")
4 disp(" Find the load current and rms value of input
        current ")
5 printf(" Given\n")
6 V2=100
7 Rf=50
8 RL=950
9 //secondary voltage
10 Vm=sqrt(2)*V2
11 //DC load current
12 Idc=(2*Vm)/(pi*(Rf+RL))
13 //RMS input current is same as RMS load current

```

```

14 Im=(Idc*%pi)/2
15 Irms=Im/sqrt(2)
16 printf("The load current=\t%f ampere\n",Idc)
17 printf("RMS load current=\t%f ampere\n",Irms)

```

Scilab code Exa 2.2.22 Calculate Average load current and voltage and Ripple voltage of FW rectifier

```

1 clc
2 disp("Example 2.22")
3 printf("\n")
4 disp("Calculate Average load current & voltage ,
      Ripple voltage")
5 printf("Given\n")
6 RL=2000
7 //diodes are ideal
8 Rf=0
9 C=500*10^-6
10 f=50
11 V2=200
12 Vm=sqrt(2)*V2
13 //average load current
14 Idc=(2*Vm)/(%pi*(Rf+RL))
15 //Average load voltage
16 Vdc=Idc*RL
17 //ripple factor
18 V=0.483
19 Vac=V*Vdc
20 //with capacitor connected across RL
21 V1=1/(4*sqrt(3)*RL*C*f)
22 //with capacitor filter we have Vdc=Vm
23 Vdc1=282.84
24 Vac1=V1*Vdc1
25 printf("Average load current=\t%f ampere\n",Idc)
26 printf("Average load voltage=\t%f ampere\n",Vdc)

```



```

27 printf("Ripple voltage=\t%f volt\n",Vac)
28 printf("Ripple voltage when capacitor connected=\t%f
    volt\n",Vac1)

```

Scilab code Exa 2.2.23 Calculate Average voltage rectification efficiency and percentage regulation of FW rectifier

```

1  clc
2  disp("Example 2.23")
3  printf("\n")
4  disp("Calculate Average voltage , rectification
    efficiency & percentage regulation")
5  printf("Given\n")
6  V2=30
7  RL=100
8  Rf=10
9  Vm=sqrt(2)*V2
10 //Average output voltage
11 Vdc=(((2*Vm)/(%pi))/(1+(Rf/RL)))
12 //Rectification effeiciency
13 nr=0.812/(1+(Rf/RL))
14 //percentage regulation
15 PR=(Rf/RL)*100
16 printf("Average output voltage=\t%f volt\n",Vdc)
17 printf("Rectification efficiency=\t%f\n",nr)
18 printf("Percentage regulation=\t%f\n",PR)

```

Scilab code Exa 2.2.24 Calculate Average load voltage RMS load current PIV DC output power Frequency of output waveform

```

1  clc
2  disp("Example 2.24")
3  printf("\n")

```

```

4  disp(" Calculate Average load voltage ,RMS load
      current ,PIV,DC o/p power ,Frequency of output
      waveform")
5  printf(" Given\n")
6  V1=220
7  N1=10
8  N2=1
9  V2=V1*(N2/N1)
10 Vm=V2
11 Rf=20
12 RL=1000
13 w=314
14 f=w/(2*%pi)
15 //Average load voltage
16 Vdc=((2*Vm)/(%pi))/(1+(Rf/RL))
17 //RMS load current
18 Irms=Vm/(sqrt(2)*(Rf+RL))
19 //PIV across each diode
20 PIV=2*Vm
21 //dc output power
22 Pdc=Vdc^2/RL
23 //Frequency of output waveform
24 Fout=2*f
25 printf("average load voltage is \n%f volt\n",Vdc)
26 printf("RMS load current is \n%f ampere\n",Irms)
27 printf("PIV across each diode is \n %f volt\n",PIV)
28 printf("DC ouput power \n%f watt\n",Pdc)
29 printf("frequency of output waveform is \n%f hz\n",
      Fout)

```

Scilab code Exa 2.2.28 Calculate all characteristics of FW bridge rectifier

```

1  clc
2  disp(" Example 2.28")
3  printf("\n")

```

```

4  disp(" Calculate DC output voltage ,Ripple factor ,
      Effeciency ,PIV ,%regulation ,Peak diode current , Dc
      load current , dc current ,RMS current")
5  printf(" Given\n")
6  Vm=100
7  Rf=25
8  RL=950
9  //dc output voltage
10 Vdc=(((2*Vm)/(%pi))/(1+(2*Rf/RL)))
11 //Ripple factor
12 Vrms=(Vm/sqrt(2))/(1+(2*Rf/RL))
13 r=sqrt((Vrms/Vdc)^2-1)
14 //Efficiency of rectification
15 Rr=0.812/(1+(2*Rf/RL))
16 //PIV across the non-conducting diode
17 PIV=Vm
18 //Percentage regulation
19 %reg=(2*Rf/RL)*100
20 //Peak load current
21 Im=Vm/(2*Rf+RL)
22 //DC load current
23 Idc=2*Im/%pi
24 //Dc current through each diode
25 Idc1=Idc/2
26 //RMS current through each diode
27 Irms1=Im/2
28 printf("dc output voltage \n%f volt\n",Vdc)
29 printf(" Ripple factor \n%f\n",r)
30 printf(" Efficiency of rectification \n%f\n",Rr)
31 printf(" PIV across non-conducting diode \n%f volt \n
      ",PIV)
32 printf(" percentage regulation \n%f\n",%reg)
33 printf(" Peak diode current \n%f ampere\n",Im)
34 printf(" dc load current \n%f ampere\n",Idc)
35 printf(" dc current through each diode \n %f ampere\n
      ",Idc1)
36 printf("RMS current through each diode \n %f ampere\
      n",Irms1)

```

Scilab code Exa 2.2.29 Calculate Average output voltage avg load current frequency of output waveform dc power output of FWBR

```
1 clc
2 disp("Example 2.29")
3 printf("\n")
4 disp("Calculate Average output voltage ,avg load
      current ,frequency of output waveform ,dc power
      output")
5 printf("Given\n")
6 Vm=141.42
7 Rf=0 //Ideal diodes
8 RL=100
9 f=50
10 //Average output voltage
11 Vdc=(((2*Vm)/(%pi))/(1+(2*Rf/RL)))
12 //Average load current
13 Idc=Vdc/RL
14 //frequency of output waveform
15 Fout=2*f
16 //dc power output
17 Pdc=Idc^2*RL
18 printf("average output voltage \n%f volt\n",Vdc)
19 printf("average load current \n%f ampere\n",Idc)
20 printf("frequency of output waveform \n%f hz\n",Fout
      )
21 printf("dc output power \n %f watt\n",Pdc)
```

Scilab code Exa 2.2.34 Calculate Ripple factor DC output voltage DC load current PIV RMS output ripple voltage of HWR

```

1  clc
2  disp(" Example 2.34")
3  printf("\n")
4  disp(" Calculate Ripple factor ,DC output voltage ,DC
      load current ,PIV,RMS output ripple voltage")
5  printf(" Given\n")
6  Vm=311.13
7  f=50
8  c=200*10^-6
9  RL=1000
10 //Ripple factor
11 r=1/(2*sqrt(3)*RL*f*c)
12 //dc output voltage
13 Vdc=Vm/(1+(1/(2*f*c*RL)))
14 //DC load current
15 Idc=Vdc/RL
16 //peak inverse voltage
17 PIV=Vm
18 //RMS ripple voltage on capacitor
19 Vac=r*Vdc
20 printf(" ripple factor \n%f\n",r)
21 printf(" dc output voltage \n%f volt\n",Vdc)
22 printf(" DC load current \n%f ampere\n",Idc)
23 printf(" PIV across the diode \n%f volt\n",PIV)
24 printf(" RMS ripple voltage on capacitor \n%f volt \n
      ",Vac)

```

Scilab code Exa 2.2.35 Calculate the capacitance of HWR

```

1  clc
2  disp(" Example 2.35")
3  printf("\n")
4  disp(" Calculate the capacitance")
5  f=50
6  RL=500

```

```

7 r=0.1
8 C=1/(2*sqrt(3)*f*RL*0.1)
9 printf("Capacitance value=\t%f Farad\n",C)

```

Scilab code Exa 2.2.40 Estimate the value of capacitor required to keep ripple factor less than 1per of FWR

```

1 clc
2 disp("Example 2.40")
3 printf("\n")
4 disp("Estimate the value of capacitor required to
      keep ripple factor less than 1%")
5 Vm=325.27
6 f=50
7 Idc=10*10^-3
8 r=0.01
9 RL=Vm/Idc
10 C=(1/r)/(4*sqrt(3)*f*RL)
11 printf("capacitor required >\t%e Farad\n",C)

```

Scilab code Exa 2.2.41 Calculate minimum value of capacitance used in the filter to keep ripple voltage below 2per of FWR

```

1 clc
2 disp("Example 2.41")
3 printf("\n")
4 disp("Calculate minimum value of capacitance used in
      the filter to keep ripple voltage below 2%")
5 Vm=282.84
6 f=50
7 Idc=12*10^-3
8 r=0.02
9 RL=Vm/Idc

```

```

10 C=(1/r)/(4*sqrt(3)*f*RL)
11 printf("capacitor required >\t%e Farad\n",C)

```

Scilab code Exa 2.2.42 Find Ripple factor Dc output voltage Ripple voltage DC load current of FWR

```

1  clc
2  disp("Example 2.42")
3  printf("\n")
4  disp("Find Ripple factor ,Dc output voltage ,Ripple
      voltage ,DC load current")
5  printf("Given\n")
6  Vm=282.84
7  f=50
8  C=500*10^-6
9  RL=2*10^3
10 //Ripple factor
11 r=1/(4*sqrt(3)*RL*f*C)
12 //Dc output voltage
13 Vdc=Vm/(1+(1/(4*f*C*RL)))
14 //Ripple voltage on capacitor
15 Vac=r*Vdc
16 //DC load current
17 Idc=Vdc/RL
18 printf("Ripple factor \n%f\n",r)
19 printf("dc ouput voltage \n%f volt\n",Vdc)
20 printf("Ripple voltage on capacitor \n%f volt\n",Vac
      )
21 printf("DC load current \n %f ampere\n",Idc)

```

Scilab code Exa 2.2.43 Find the ripple factor and output voltage if a capacitor of 160uf is connected in parallel with load of FWR

```

1  clc
2  disp(" Example 2.43")
3  printf("\n")
4  disp(" Find the ripple factor & output voltage if a
      capacitor of 160uf is connected in parallel with
      load")
5  RL=250
6  C=160*10^-6
7  f=50
8  Vm=49.497
9  //ripple factor
10 r=1/(4*sqrt(3)*f*RL*C)
11 //Dc output voltage
12 Vdc=Vm/(1+(1/(4*f*C*RL)))
13 printf(" ripple factor \n %f\n",r)
14 printf("DC output voltage \n%f volt\n",Vdc)

```

Scilab code Exa 2.2.44 Find the ripple factor and DC load current of FWBR

```

1  clc
2  disp(" Example 2.44")
3  printf("\n")
4  disp(" Find the ripple factor & DC load current")
5  printf(" Given\n")
6  Vm=230
7  f=(314/(2*pi))
8  RL=400
9  C=500*10^-6
10 //ripple factor
11 r=1/(4*sqrt(3)*f*RL*C)
12 //DC load current
13 Vdc=Vm/(1+(1/(4*f*C*RL)))
14 Idc=Vdc/RL
15 printf(" ripple factor \n %f\n",r)

```



```
16 printf("DC laod current \n%f ampere\n",Idc)
```

Scilab code Exa 2.2.45 Find the capacitor value for half wave rectifier

```
1 clc
2 disp("Example 2.45")
3 printf("\n")
4 disp("Find the capacitor value for half wave
      rectifier")
5 Vdc=20
6 f=60
7 RL=500
8 r=0.1/(2*sqrt(3))
9 c=1/(2*sqrt(3)*r*f*RL)
10 printf("Capacitor value =\t%e farad\n",c)
```

Scilab code Exa 2.2.46 Find the capacitor value for full wave rectifier

```
1 clc
2 disp("Example 2.46")
3 printf("\n")
4 disp("Find the capacitor value for full wave
      rectifier")
5 printf("Given\n")
6 Vdc=20
7 f=60
8 RL=500
9 r=0.1/(2*sqrt(3))
10 c=1/(4*sqrt(3)*r*f*RL)
11 printf("Capacitor value =\t%e farad\n",c)
```

Scilab code Exa 2.2.50 calculate load and source effects and load and line regulation

```
1 clc
2 disp("Example 2.50")
3 printf("\n")
4 disp("calculate load & source effects & the load &
   line regulation")
5 printf("Given\n")
6 Vo1=20
7 Vo2=19.7
8 //load effect=delVo for delIL(max)
9 LE=Vo1-Vo2
10 //Load regulation
11 LR=(LE*100)/Vo1
12 //source effect=delVo for 10% change in Vs
13 V=20.2
14 SE=V-Vo1
15 //Line regulation
16 LiR=(SE/Vo1)*100
17 printf("load effect \n %f volt\n",LE)
18 printf("load regulation \n%f \n",LR)
19 printf("source effect \n %f volt\n",SE)
20 printf("line regulation \n%f\n",LiR)
```

Scilab code Exa 2.2.51 calculate load and source effects and load and line regulation

```
1 clc
2 disp("Example 2.51")
3 printf("\n")
4 disp("calculate load & source effects & load & line
   regulation")
5 printf("Given\n")
6 Vo1=15
```

```

7 Vo2=14.9
8 //load effect=delVo for delIL(max)
9 LE=Vo1-Vo2
10 //Load regulation
11 LR=LE*100/Vo1
12 //source effect=delVo for 10% change in Vs
13 V=14.95
14 SE=Vo1-V
15 //Line regulation
16 LiR=(SE/Vo1)*100
17 printf("load effect \n %f volt\n",LE)
18 printf("load regulation \n%f \n",LR)
19 printf("source effect \n %f volt\n",SE)
20 printf("line regulation \n%f\n",LiR)

```

Scilab code Exa 2.2.54 Design the Zener Diode Voltage regulator for given specification

```

1 clc
2 disp("Example 2.54")
3 printf("\n")
4 disp("Design the Zener Diode Voltage regulator for
      given specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //unregulated dc input voltage
8 Vimin=8
9 Vimax=12
10 //regulated dc output voltage
11 Vo=5
12 //minimum zener current
13 Izmin=5*10^-3
14 //maximum zener current
15 Izmax=80*10^-3

```

```

16 //load current
17 ILmin=0
18 ILmax=20*10^-3
19 //load resistance
20 RL=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)

```

Scilab code Exa 2.2.55 Design a zener diode voltage regulator to meet following specification

```

1 clc
2 disp("Example 2.55")
3 printf("\n")
4 disp("Design a zener diode voltage regulator to meet
      following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //unregulated dc input voltage
8 Vimin=13
9 Vimax=17
10 //Load current
11 ILmin=0
12 ILmax=10*10^-3
13 //regulated output voltage
14 Vo=10
15 //minimum zener current

```

```

16 Izmin=5*10^-3
17 //Maximum power dissipation
18 Pzmax=500*10^-3
19 //maximum zener current
20 Izmax=Pzmax/Vo
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 //load resistance
28 RLmin=Vo/ILmax
29 printf("minimum resistance %d ohm \n",Rmin)
30 printf("maximum resistance %d ohm \n",Rmax)
31 printf("required resistance %d ohm \n",R)
32 printf("load resistance %d ohm \n",RLmin)

```

Scilab code Exa 2.2.56 Design a zener diode voltage regulator to meet following specification

```

1 clc
2 disp("Example 2.56")
3 printf("\n")
4 disp("Design a zener diode voltage regulator to meet
      following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //dc input voltage
8 Vimin=20
9 Vimax=Vimin
10 //dc output voltage
11 Vo=10
12 //load current

```

```

13 ILmin=0
14 ILmax=20*10^-3
15 //minimum zener current
16 Izmin=10*10^-3
17 //maximum zener current
18 Izmax=100*10^-3
19 //load resistance
20 RLmin=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)
30 printf("load resistance %d ohm \n",RLmin)

```

Scilab code Exa 2.2.57 Calculate the value of series resistance and Zener diode current when load is 1200ohm

```

1 clc
2 disp("Example 2.57")
3 printf("\n")
4 disp("Calculate the value of series resistance &
      Zener diode current when load is 1200ohm")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //Input voltage
8 Vi=32
9 //Zener diode voltage
10 Vz=24
11 //maximum power

```

```

12 Pzmax=600*10^-3
13 //output voltage
14 Vo=24
15 //since Vi has no variation
16 Vimax=32
17 Vimin=Vimax
18 //Zener current
19 Izmax=Pzmax/Vz
20 //series resistance
21 ILmin=0
22 R=(Vimax-Vo)/(Izmax+ILmin)
23 //Diode current
24 RL=1200
25 IL=Vo/RL //load current
26 I=(Vi-Vo)/R //total current
27 IZ=I-IL
28 printf("The diode current=\t%f ampere\n",IZ)

```

Scilab code Exa 2.2.58 Design a voltage regulator using zener diode to meet following specification

```

1 clc
2 disp(" Example 2.58")
3 printf("\n")
4 disp("Design a voltage regulator using zener diode
to meet following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
ampere \n 3 voltage sources are in volt\n")
7 //unregulated dc input voltage
8 Vimin=20
9 Vimax=30
10 //regulated dc output voltage
11 Vo=10
12 //minimum zener current

```

```

13 Izmin=2*10^-3
14 //maximum zener current
15 Izmax=100*10^-3
16 //load current
17 ILmin=0
18 ILmax=25*10^-3
19 //load resistance
20 RL=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)
30 printf("load resistance %d ohm \n",RLmin)

```

Scilab code Exa 2.2.59 Design a zener voltage regulator to meet following specification

```

1 clc
2 disp("Example 2.59")
3 printf("\n")
4 disp("Design a zener voltage regulator to meet
      following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //DC input voltage
8 Vimin=10-2
9 Vimax=10+2
10 //DC output voltage
11 Vo=5

```



```

12 //Load current
13 ILmax=10*10^-3
14 ILmin=0
15 //zener wattage
16 Pzmax=400*10^-3
17 Vz=Vo
18 //maximum zener current
19 Izmax=Pzmax/Vz
20 //since Izmin is not given so let us take IZmin=5mA
21 Izmin=5*10^-3
22 //maximum Resistance
23 Rmax=(Vimin-Vo)/(Izmin+ILmax)
24 //minimum resistance
25 Rmin=(Vimax-Vo)/(Izmax+ILmin)
26 //Required resistance
27 R=(Rmax+Rmin)/2
28 //load resistance
29 RL=Vo/ILmax
30 printf("minimum resistance %d ohm \n",Rmin)
31 printf("maximum resistance %d ohm \n",Rmax)
32 printf("required resistance %d ohm \n",R)
33 printf("load resistance %d ohm \n",RL)

```

Scilab code Exa 2.2.60 Design a zener voltage regulator to meet following specification

```

1 clc
2 disp(" Example 2.60")
3 printf("\n")
4 disp(" Design a zener voltage regulator to meet
      following specification")
5 printf(" Given\n")
6 printf(" 1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //DC input voltage(10V[+-]20%)

```

```

8  Vimin=10-2
9  Vimax=10+2
10 //DC output voltage
11 Vo=5
12 //Load current
13 ILmax=20*10^-3
14 ILmin=0
15 //zener current
16 Izmax=80*10^-3
17 Izmin=5*10^-3
18 //maximum Resistance
19 Rmax=(Vimin-Vo)/(Izmin+ILmax)
20 //minimum resistance
21 Rmin=(Vimax-Vo)/(Izmax+ILmin)
22 //Required resistance
23 R=(Rmax+Rmin)/2
24 //load resistance
25 RL=Vo/ILmax
26 printf("minimum resistance %d ohm \n",Rmin)
27 printf("maximum resistance %d ohm \n",Rmax)
28 printf("required resistance %d ohm \n",R)
29 printf("load resistance %d ohm \n",RL)

```

Scilab code Exa 2.2.61 Design a zener voltage regulator to meet following specification

```

1  clc
2  disp(" Example 2.61 ")
3  printf("\n")
4  disp(" Design a zener voltage regulator to meet
      following specification ")
5  printf(" Given \n ")
6  printf(" 1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt \n ")
7  //DC input voltage

```

```

8  Vimin=12-3
9  Vimax=12+3
10 //DC output voltage
11 Vo=5
12 //Load current
13 ILmax=20*10^-3
14 ILmin=0
15 //zener wattage
16 Pzmax=500*10^-3
17 Vz=Vo
18 //maximum zener current
19 Izmax=Pzmax/Vz
20 //since Izmin is not given so let us take IZmin=5mA
21 Izmin=5*10^-3
22 //maximum Resistance
23 Rmax=(Vimin-Vo)/(Izmin+ILmax)
24 //mini resistance
25 Rmin=(Vimax-Vo)/(Izmax+ILmin)
26 //Required resistance
27 R=(Rmax+Rmin)/2
28 //load resistance
29 RL=Vo/ILmax
30 printf("minimum resistance %d ohm \n",Rmin)
31 printf("maximum resistance %d ohm \n",Rmax)
32 printf("required resistance %d ohm \n",R)
33 printf("load resistance %d ohm \n",RL)

```

Scilab code Exa 2.2.63 Design a 6V dc reference source to operate from a 16v supply

```

1  clc
2  disp("Example 2.63")
3  printf("\n")
4  disp("Design a 6V dc reference source to operate
      from a 16v supply")

```

```

5 printf(" Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")
7 //output voltage
8 Vo=6
9 //input voltage
10 Vi=16
11 //zener power
12 Pzmax=400*10^-3
13 //zener current maximum
14 Izmax=Pzmax/Vo
15 //I=Iz+IL & ILmin=0, we have Izmax=I
16 //take Izmin=5*10^-3
17 Izmin=5*10^-3
18 //maximum load current
19 ILmax=Izmax-Izmin
20 //load resistance
21 RLmin=Vo/ILmax
22 //series resistance
23 R=(Vi-Vo)/Izmax
24 printf("maximum load current %d ampere\n",ILmax)
25 printf("Load resistance %d ohm\n",RLmin)
26 printf("sereies resistance %d ohm\n",R)

```

Scilab code Exa 2.2.64 Design a 8V dc reference source to operate from a 20v supply and find maximum load current

```

1 clc
2 disp(" Example 2.64")
3 printf("\n")
4 disp(" Design a 8V dc reference source to operate
    from a 20v supply and find maximum load current")
5 printf(" Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")

```

```

7 //output voltage
8 Vo=8
9 //input voltage
10 Vi=20
11 //zener power
12 Pzmax=400*10^-3
13 //zener current maximum
14 Izmax=Pzmax/Vo
15 //I=Iz+IL & ILmin=0, we have Izmax=I
16 //take Izmin=5*10^-3
17 Izmin=5*10^-3
18 //maximum load current
19 ILmax=Izmax-Izmin
20 //load resistance
21 RLmin=Vo/ILmax
22 //series resistance
23 R=(Vi-Vo)/Izmax
24 printf("maximum load current %d ampere\n",ILmax)
25 printf("Load resistance %d ohm\n",RLmin)
26 printf("series resistance %d ohm\n",R)

```

Scilab code Exa 2.2.65 Calculate circuit current when supply voltage drops to 27V select suitable components

```

1 clc
2 disp("Example 2.65")
3 printf("\n")
4 disp("Calculate circuit current when supply voltage
      drops to 27V, select suitable components")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //input voltage
8 Vi=30
9 //output voltage

```

```

10 Vo=9
11 //test current(lies b/w Izmin & Izmax)
12 Iz=20*10^-3
13 //load current(assume zero , no load operation)
14 IL=0
15 //circuit current
16 I=Iz
17 //series resistance
18 R=(Vi-Vo)/I
19 //zener current when Vi drops to 27V
20 Vi1=27
21 Iz=(Vi1-Vo)/R
22 printf("Zener current is %f ampere\n",Iz)

```

Scilab code Exa 2.2.66 Calculate the effect of a 10per variation supply voltage on diode current

```

1 clc
2 disp("Example 2.66")
3 printf("\n")
4 disp("Calculate the effect of a 10% variation supply
      voltage on diode current")
5 printf("Given\n")
6 //input voltage
7 Vi=25
8 //output voltage
9 Vo=10
10 //test current(lies b/w Izmin & Izmax)
11 Iz=20*10^-3
12 //load current(assume zero , no load operation)
13 IL=10^-3
14 //select R such that
15 Iz=Iz
16 //series resistance
17 R=(Vi-Vo)/(Iz+IL)

```

```

18 //maximum input voltage
19 Vimax=25+2.5
20 //minimum input voltage
21 Vimin=25-2.5
22 //circuit current
23 I1=(Vimax-Vo)/R
24 //zener current when Vimax
25 Izmax=I1-IL
26 //circuit current when Vimin
27 I2=(Vimin-Vo)/R
28 //zener current when Vimin
29 Izmin=I2-IL
30 printf("circuit current when Vimax is %f ampere\n",
        I1)
31 printf("zener current when Vimax is %f ampere\n",
        Izmax)
32 printf("circuit current when Vimin is %f ampere\n",
        I2)
33 printf("zener current when Viin is %f ampere\n",
        Izmin)

```

Scilab code Exa 2.2.68 Calculate the line regulation output resistance load regulation and ripple rejection ratio

```

1 clc
2 disp("Example 2.68")
3 printf("\n")
4 disp("Calculate the line regulation , output
        resistance , load regulation & ripple rejection
        ratio")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
        ampere \n 3 voltage sources are in volt\n")
7 //input voltage
8 Vi=16

```

```

 9 //output voltage
10 Vo=6
11 //load current
12 ILmax=60*10^-3
13 //dynamic impedance
14 Zz=7
15 //series resistance
16 R=150
17 //Source effect
18 delVi=(10*16)/100
19 RL=Vo/ILmax
20 //Zz || RL
21 Rp=(Zz*RL)/(Zz+RL)
22 delVo=(delVi*Rp)/(R+Rp)
23 //Line regulation
24 LR=(delVo*100)/Vo
25 //load effect
26 delIL=ILmax
27 Ro=(Zz*R)/(Zz+R)
28 delVo1=delIL*Ro
29 //output resistance
30 Rout=Ro
31 //Ripple rejection ratio
32 VrobyVri=Rp/(R+Rp)
33 printf("line regulation is %f \n",LR)
34 printf("output resistance is %d ohm\n",Rout)
35 printf("Ripple rejection ratio %f \n",VrobyVri)

```

Chapter 3

pnp and npn Transistors

Scilab code Exa 3.3.14 calculate the value of I_c I_e β for a transistor

```
1 clc
2 disp("Example 3.14")
3 printf("\n")
4 disp("calculate the value of  $I_c$ ,  $I_e$ ,  $\beta$  for a
      transistor")
5 printf("Given\n")
6 alpha=0.98
7 //base current
8 Ib=120*10^-6
9 //Value of  $I_c$ 
10 Ic=alpha*Ib/(1-alpha)
11 //Value of  $I_e$ 
12 Ie=Ic+Ib
13 //value of  $\beta$ 
14 beta=alpha/(1-alpha)
15 printf("base current \n%f ampere\n",Ib)
16 printf("collector current \n%f ampere\n",Ic)
17 printf("Emitter current \n%f ampere\n",Ie)
18 printf("beta \n%f\n",beta)
```

Scilab code Exa 3.3.15 Find the value of alpha and beta of transistor and Ib for desired Ic

```
1 clc
2 disp("Example 3.15")
3 printf("\n")
4 disp("Find the value of alpha & beta of transistor
      and Ib for desired Ic")
5 printf("Given\n")
6 Ic=1.2*10^-3
7 Ib=20*10^-6
8 //the value of beta
9 beta=Ic/Ib
10 //the value of alpha
11 alpha=beta/(1+beta)
12 //the value of Ib for desired value of Ic=5mA
13 Ic1=5*10^-3
14 Ib1=Ic1/beta
15 printf("beta \n%f\n",beta)
16 printf("alpha \n%f\n",alpha)
17 printf("base current when collector current is 5mA
      is \n%f ampere\n",Ib1)
```

Scilab code Exa 3.3.16 calculate the value of alpha beta and Ib for a transistor

```
1 clc
2 disp("Example 3.16")
3 printf("\n")
4 disp("calculate the value of alpha ,Ib ,beta for a
      transistor")
5 printf("Given\n")
```

```

6 //collector current
7 Ic=2.5*10^-3
8 //emitter current
9 Ie=2.55*10^-3
10 //Value of alpha
11 alpha=Ic/Ie
12 //Value of Ib
13 Ib=Ie-Ic
14 //value of beta
15 beta=Ic/Ib
16 printf(" collector current \n%f ampere\n",Ic)
17 printf(" Emitter current \n%f ampere\n",Ie)
18 printf(" alpha \n%f\n",alpha)
19 printf(" base current \n%f ampere\n",Ib)
20 printf(" beta \n%f\n",beta)

```

Scilab code Exa 3.3.17 calculate the value of beta for transistor and find new collector current when beta of new transistor is 70

```

1 clc
2 disp(" Example 3.17")
3 printf("\n")
4 disp(" calculate the value of beta for transistor .
      find new collector current when beta of new
      transistor is 70")
5 printf(" Given\n")
6 //old transistor
7 Ic=3*10^-3
8 Ie=3.03*10^-3
9 //find Ib
10 Ib=Ie-Ic
11 //value of beta
12 beta=Ic/Ib
13 //for new transistor beta=70
14 beta1=70

```

```

15 //the value of Ic
16 Ic=beta1*Ib
17 printf("base current \n%f ampere\n",Ib)
18 printf("beta \n%f\n",beta)
19 printf("new value of collector current for beta 70
    is \n%f ampere\n",Ic)

```

Scilab code Exa 3.3.18 calculate the value of Ic Ie for a transistor and Find beta for transistor

```

1 clc
2 disp("Example 3.18")
3 printf("\n")
4 disp("calculate the value of Ic,Ie for a transistor.
    Find beta for transistor")
5 printf("Given\n")
6 //For old transistor
7 alpha=0.97
8 Ib=50*10^-6
9 //value of collector current
10 Ic=alpha*Ib/(1-alpha)
11 //value of emitter current
12 Ie=Ic/alpha
13 //value of beta
14 beta=Ic/Ib
15 printf("collector current \n%f ampere\n",Ic)
16 printf("Emitter current \n%f ampere\n",Ie)
17 printf("beta \n%f\n",beta)

```

Scilab code Exa 3.3.19 calculate the value of Ie alpha beta for a transistor and find Ib for new value of Ic

```

1 clc

```

```

2 disp("Example 3.19")
3 printf("\n")
4 disp("calculate the value of Ie ,alpha ,beta for a
      transistor and find Ib for new value of Ic")
5 printf("Given\n")
6 //for old transistor
7 Ic=5.25*10^-3
8 Ib=100*10^-6
9 //value of Ie
10 Ie=Ic+Ib
11 //value of alpha
12 alpha=Ic/Ie
13 //value of beta
14 beta=Ic/Ib
15 //for new value of Ib the Ic value is
16 Ic1=15*10^-3
17 Ib=Ic1/beta
18 printf("emitter current \n%f ampere\n",Ie)
19 printf("alpha \n%f\n",alpha)
20 printf("beta \n%f\n",beta)
21 printf("new base current \n%f ampere\n",Ib)

```

Scilab code Exa 3.3.20 calculate the value of Ic and Ie for a transistor

```

1 clc
2 disp("Example 3.20")
3 printf("\n")
4 disp("calculate the value of Ic ,Ie for a transistor")
5 printf("Given\n")
6 alpha=0.99
7 //base current
8 Ib=20*10^-6
9 //value of collector current
10 Ic=alpha*Ib/(1-alpha)

```

```

11 //value of emitter current
12 Ie=Ic+Ib
13 printf("base current \n%f ampere\n",Ib)
14 printf("collector current \n%f ampere\n",Ic)
15 printf("Emitter current \n%f ampere\n",Ie)

```

Scilab code Exa 3.3.21 calculate the value of I_c alpha beta for a transistor and I_c when I_b is 150uA

```

1 clc
2 disp("Example 3.21")
3 printf("\n")
4 disp("calculate the value of  $I_c$ , alpha, beta for a
      transistor and  $I_c$  when  $I_b=150\mu A$ ")
5 printf("Given\n")
6 Ic=12.42*10^-3
7 Ib=200*10^-6
8 //value of Ie
9 Ie=Ic+Ib
10 //value of alpha
11 alpha=Ic/Ie
12 //value of beta
13 beta=Ic/Ib
14 //value of  $I_c$  when  $I_b=150\mu A$ 
15 Ib1=150*10^-6
16 Ic=beta*Ib1
17 printf("Emitter current \n%f ampere\n",Ie)
18 printf("alpha \n%f\n",alpha)
19 printf("beta \n%f\n",beta)
20 printf("collector current \n%f ampere\n",Ic)

```

Scilab code Exa 3.3.22 calculate the value of I_b beta for a transistor and I_c I_e for new value of beta

```

1  clc
2  disp(" Example 3.22")
3  printf("\n")
4  disp(" calculate the value of Ib ,beta for a
        transistor and Ic , Ie for new value of beta")
5  printf(" Given\n")
6  Ic=16*10^-3
7  Ie=16.04*10^-3
8  //base current
9  Ib=Ie-Ic
10 //beta value
11 beta=Ic/Ib
12 //for beta=25
13 beta1=25
14 Ic1=beta1*Ib
15 Ie1=Ic1+Ib
16 printf(" base current \n%f ampere\n",Ib)
17 printf(" beta \n%f\n",beta)
18 printf(" emitter current \n%f ampere\n",Ie1)

```

Scilab code Exa 3.3.25 Find the DC collector voltage and voltage gain of ckt for V_i is 50mV

```

1  clc
2  disp(" Example 3.25")
3  printf("\n")
4  disp(" Find the DC collector voltage & voltage gain
        of circuit for Vi=50mV")
5  printf(" Given\n")
6  //base current for Vbe=0.7
7  Ib=30*10^-6
8  Vbe=0.7
9  beta=80
10 //collector current
11 Ic=beta*Ib

```

```

12 //given from ckt
13 Vcc=20
14 Rc=5.8*10^3
15 //writing KVL for Common Emitter circuit
16 Vc=Vcc-(Ic*Rc)
17 //for input characteristics delVi=delVb=50mV
18 Vi=50*10^-3
19 delIb=5*10^-6
20 Ic1=beta*delIb
21 //output voltage
22 Vo=Ic1*Rc
23 //voltage gain
24 Av=Vo/Vi
25 printf("Dc collector voltage \n%f volt\n",Vc)
26 printf("voltage gain \n%f\n",Av)

```

Scilab code Exa 3.3.26 Find the DC current gain for circuit fig 15 and ac voltage gain

```

1 clc
2 disp("Example 3.26")
3 printf("\n")
4 disp("Find the DC current gain for circuit fig 3.15
   and ac voltage gain")
5 printf("Given\n")
6 //to find dc current gain
7 //given
8 Vcc=15
9 Vc=7
10 Rc=5.6*10^3
11 Ib=20*10^-6
12 //to find Vrc
13 Vrc=Vcc-Vc
14 //collector current
15 Ic=Vrc/Rc

```



```

16 //dc current gain
17 betadc=Ic/Ib
18 //to find ac voltage gain
19 //given
20 Vi=50*10-3
21 delIb=10*10-6
22 delIc=betadc*delIb
23 //output voltage
24 Vo=delIc*Rc
25 //voltage gain
26 Av=Vo/Vi
27 printf("DC current gain \n%f\n",betadc)
28 printf("voltage gain \n%f\n",Av)

```

Scilab code Exa 3.3.27 Find the parameters of the ckt of question 27

```

1 clc
2 disp("Example 3.27")
3 printf("\n")
4 disp("Find the following terms as given in question
      3.27")
5 printf("Given\n")
6 //to find collector voltage
7 //given
8 Vbe=0.7
9 Ib=30*10-6
10 beta=50
11 Rc=12*103
12 Vcc=25
13 //collector current
14 Ic=beta*Ib
15 //collector voltage
16 Vc=Vcc-(Ic*Rc)
17 //to find voltage gain
18 //given

```

```

19 Vi=50*10^-3
20 Ib1=15*10^-6
21 Ic1=beta*Ib1
22 Vo=Ic1*Rc
23 //voltage gain
24 Av=Vo/Vi
25 //to find Vce
26 //given
27 Vbe=0.73
28 Ib2=40*10^-6
29 Ic2=beta*Ib2
30 Vce=Vcc-(Ic2*Rc)
31 //to find voltage gain when Rc changed to 6.8k
32 Rc1=6.8*10^3
33 Vo1=Ic1*Rc1
34 Av1=Vo1/Vi
35 //to find current gain of replaced transistor
36 //given
37 Vc1=9
38 Vrc=Vcc-Vc1
39 Ic3=Vrc/Rc
40 beta1=Ic3/Ib
41 printf("collector voltage \n%f volt \n",Vc)
42 printf("Voltage gain for vi=50mv \n%f\n",Av)
43 printf("Vce if Vbe=0.73 is \n%f volt\n",Vce)
44 printf("Voltage gain when Rc=6.8k \n%f Volt\n",Av1)
45 printf("current gain of replaced transistor \n%f\n",
    beta1)

```

Scilab code Exa 3.3.34 Obtain the CB current gain and output characteristics

```
1 clc
```

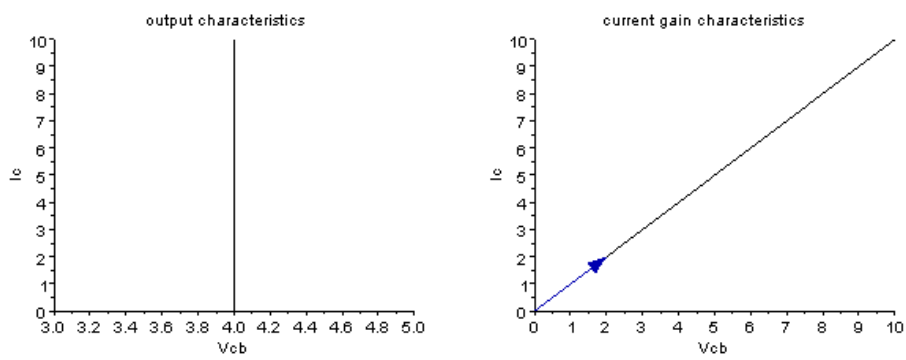


Figure 3.1: Obtain the CB current gain and output characteristics

```

2 disp("Example 3.34")
3 printf("\n")
4 disp("Obtain the Common base current gain & output
      characteristics")
5 printf("Given\n")
6 Vcb=[ 4 4 4 4 4 4 ]
7 Ic=[ 0 2 4 6 8 10]
8 subplot(221)
9 plot2d(Vcb,Ic)
10 xlabel("Vcb in volt")
11 ylabel("Ic in Ampere")
12 xtitle("output characteristics")
13 Ic1=[0 2 10 ]
14 Ie=[0 2 10 ]
15 subplot(222)
16 plot2d(Ie,Ic1)
17 xarrows(Ie,Ic1,2,2)
18 xarrows(Ie,Ic1,10,10)
19 xlabel("Vcb in volt")
20 ylabel("Ic in Ampere")
21 xtitle("current gain characteristics")

```

Scilab code Exa 3.3.46 For the circuit given draw a DC load line

```

1 clc
2 disp("Example 3.46")
3 printf("\n")
4 disp("For the circuit shown in example 3.46 draw a
      DC load line")
5 printf("Given\n")
6 //to find Vce value when Ic=0
7 Ic1=0
8 //given
9 Rc=12*10^3
10 Vcc=20

```

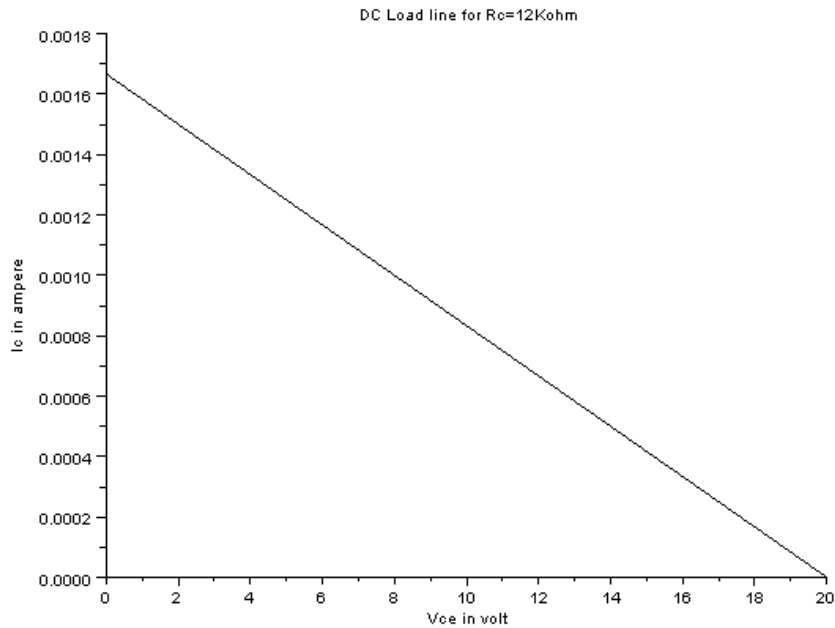


Figure 3.2: For the circuit given draw a DC load line

```

11 //from circuit
12 Vce=Vcc-(Ic1*Rc)
13 //to find Ic when Vce=0
14 Vce1=0
15 Ic=Vcc/Rc
16 //To draw DC load line
17 Vceg=[Vce, Vce1]
18 Icg=[Ic1, Ic]
19 plot2d(Vceg, Icg)
20 xlabel("Vce in volt")
21 ylabel("Ic in ampere")
22 xtitle("DC Load line for Rc=12Kohm")

```

Scilab code Exa 3.3.50 Draw a DC load line for the base bias circuit

```
1  clc
2  disp(" Example 3.50")
3  printf("\n")
4  disp("Draw a DC load line for the base bias circuit"
      )
5  printf(" Given\n")
6  //given
7  Rc=2.2*10^3
8  Rb=470*10^3
9  Vcc=18
10 Vbe=0.7
11 hFE=100
12 //find the Ib
13 Ib=(Vcc-Vbe)/Rb // from circuit
14 //find the Ic
15 Icq=hFE*Ib
16 //find the Vceq
17 Vceq=Vcc-(Icq*Rc)
18 //to draw Dc load line
19 Ic1=Vcc/Rc
20 Vce1=Vcc
21 Vce=[Vcc Vceq 0]
22 Ic=[0 Icq Ic1]
23 printf("Q(%f,%f)\n",Vceq,Icq)
24 plot2d(Vce, Ic)
25 xlabel("Vce in volt")
26 ylabel("Ic in Ampere")
27 xtitle("DC load line for base bias circuit")
```

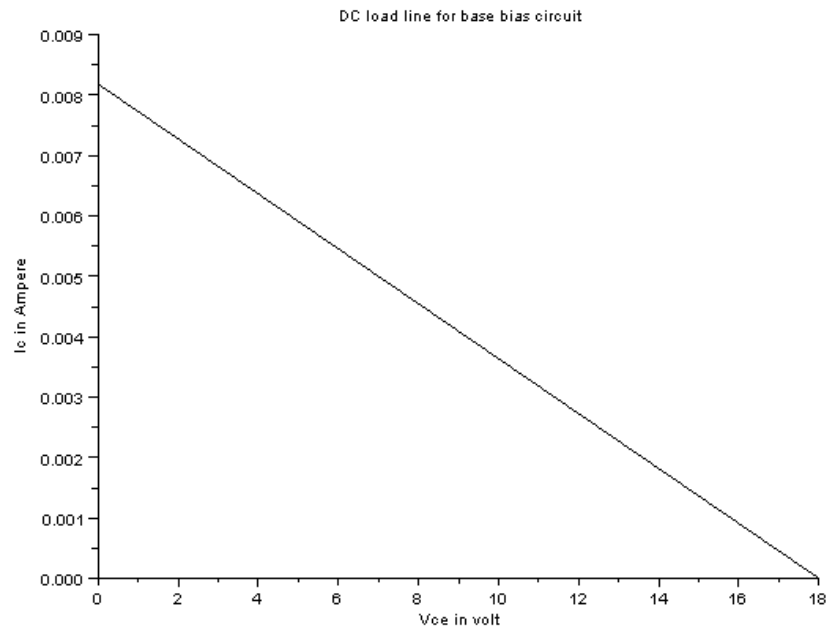


Figure 3.3: Draw a DC load line for the base bias circuit

Scilab code Exa 3.3.51 Draw a DC load line for the base bias circuit for different hFE

```
1  clc
2  disp("Example 3.51")
3  printf("\n")
4  disp("Draw a DC load line for the base bias circuit
      for different hFE")
5  printf("Given\n")
6  //given
7  Rc=2.2*10^3
8  Rb=470*10^3
9  Vcc=18
10 Vbe=0.7
11 hFE1=50
12 hFE2=200
13 //find the Ib
14 Ib=(Vcc-Vbe)/Rb // from circuit
15 //find the Ic for hFE1
16 Icq1=hFE1*Ib
17 //find the Vceq1
18 Vceq1=Vcc-(Icq1*Rc)
19 //find the Ic for hFE2
20 Icq2=hFE2*Ib
21 //find the Vceq2
22 Vceq2=Vcc-(Icq2*Rc)
23 //to draw Dc load line
24 Ic1=Vcc/Rc
25 Vce1=Vcc
26 Vce=[Vcc Vceq1 Vceq2 0]
27 Ic=[0 Icq1 Icq2 Ic1]
28 printf("Q1(%f volt ,%f ampere)\n",Vceq1,Icq1)
29 printf("Q2(%f volt ,%f ampere)\n",Vceq2,Icq2)
30 plot2d(Vce, Ic)
```

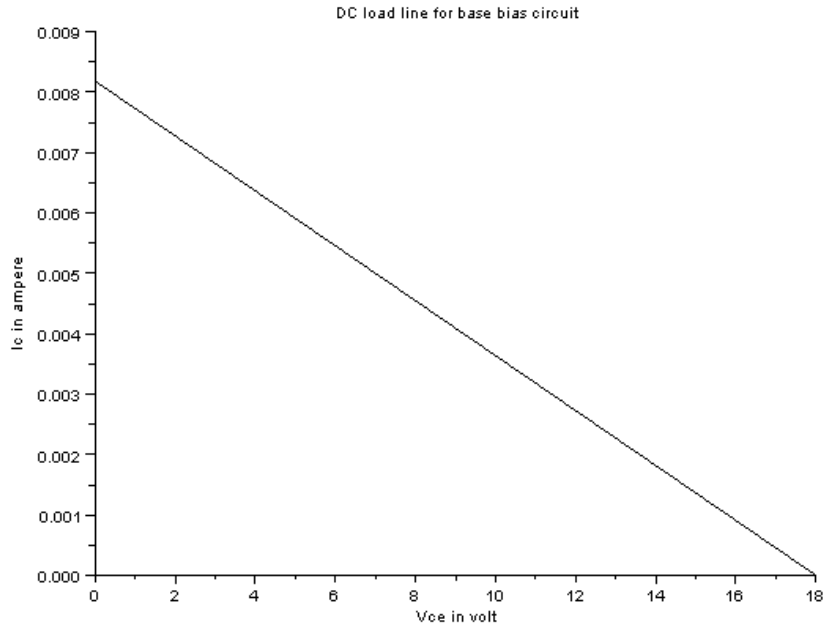



Figure 3.4: Draw a DC load line for the base bias circuit for different hFE

```

31 xlabel("Vce in volt")
32 ylabel("Ic in ampere")
33 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.52 Find I_c and V_{ce} and Draw a DC load line for the base bias circuit

```

1 clc
2 disp(" Example 3.52")
3 printf("\n")
4 disp(" Find Ic & Vce. Draw a DC load line for the

```

```

        base bias circuit")
5  printf("Given\n")
6  //given
7  betadc=100
8  Vbe=0.7
9  Rc=10^3
10 Rb=10^5
11 Vb=5
12 Vc=10
13 //to find Ib
14 Ib=(Vb-Vbe)/Rb //from circuit
15 //Ic value
16 Icq=betadc*Ib
17 //Vce value
18 Vceq=Vc-(Icq*Rc)
19 //to draw DC load line
20 Ic1=Vc/Rc
21 Vce1=Vc
22 Vce=[Vc Vceq 0]
23 Ic=[0 Icq Ic1]
24 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
25 plot2d(Vce, Ic)
26 xlabel("Vce in volt")
27 ylabel("Ic in ampere")
28 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.53 Find Ic and Vce and Draw a DC load line for the base bias circuit

```

1  clc
2  disp("Example 3.53")
3  printf("\n")
4  disp(" Find Ic & Vce. Draw a DC load line for the

```

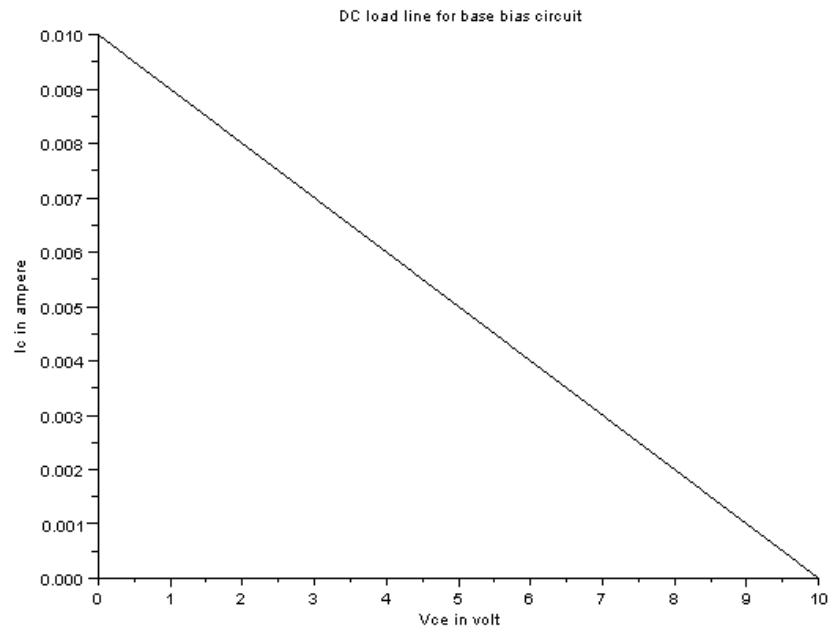


Figure 3.5: Find I_c and V_{ce} and Draw a DC load line for the base bias circuit

```

    base bias circuit")
5  printf("Given\n")
6  //given
7  betadc=50
8  Vbe=0.7
9  Rc=2.2*10^3
10 Rb=240*10^3
11 Vc=12
12 //to find Ib
13 Ib=(Vc-Vbe)/Rb //from circuit
14 //Ic value
15 Icq=betadc*Ib
16 //Vce value
17 Vceq=Vc-(Icq*Rc)
18 //to draw DC load line
19 Ic1=Vc/Rc
20 Vce1=Vc
21 Vce=[Vc Vceq 0]
22 Ic=[0 Icq Ic1]
23 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
24 plot2d(Vce, Ic)
25 xlabel("Vce in volt")
26 ylabel("Ic in ampere")
27 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.54 Draw a DC load line for the base bias circuit neglecting V_{be}

```

1  clc
2  disp("Example 3.54")
3  printf("\n")
4  disp(" Draw a DC load line for the base bias circuit
    neglecting Vbe")

```

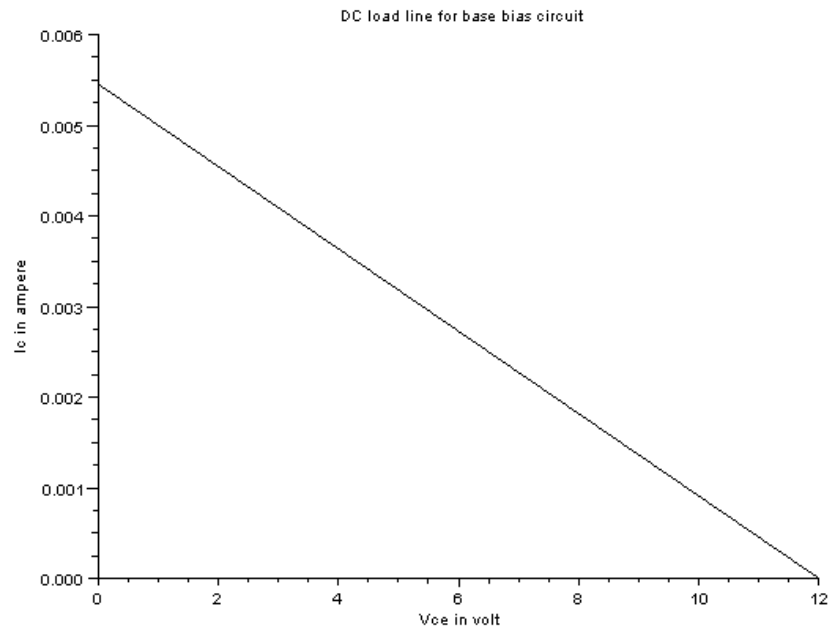


Figure 3.6: Find I_c and V_{ce} and Draw a DC load line for the base bias circuit

```

5 printf(" Given\n")
6 //given
7 betadc=100
8 Rc=5*10^3
9 Rb=1.5*10^6
10 Vc=30
11 //to find Ib
12 Ib=Vc/Rb //from circuit
13 //Ic value
14 Icq=betadc*Ib
15 //Vce value
16 Vceq=Vc-(Icq*Rc)
17 //to draw DC load line
18 Ic1=Vc/Rc
19 Vce1=Vc
20 Vce=[Vc Vceq 0]
21 Ic=[0 Icq Ic1]
22 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
23 plot2d(Vce, Ic)
24 xlabel("Vce in volt")
25 ylabel("Ic in ampere")
26 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.55 Calculate transistor hFE and new Vce level for hFE is 100 of base bias circuit

```

1 clc
2 disp(" Example 3.55")
3 printf("\n")
4 disp(" Calculate transistor hFE & new Vce level for
      hFE=100 of base bias circuit")
5 printf(" Given\n")
6 //given

```

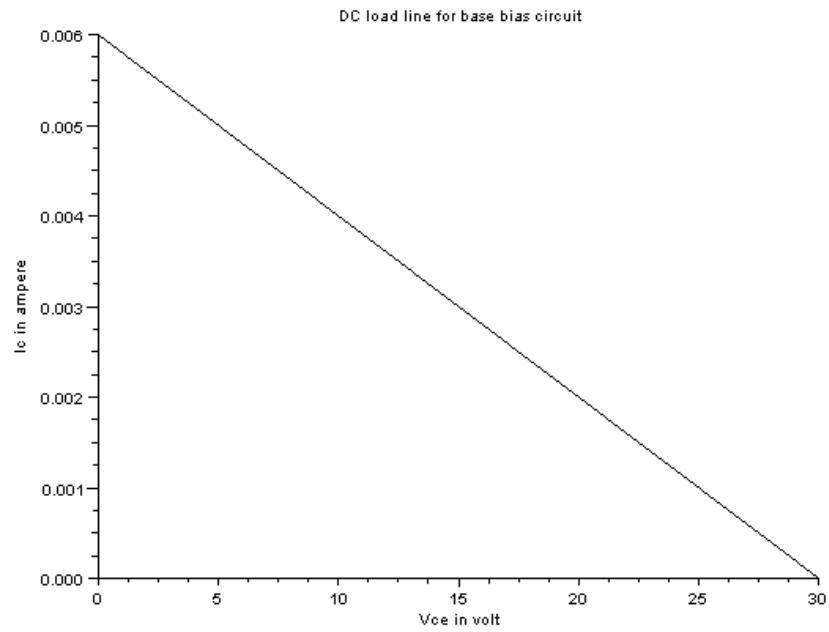


Figure 3.7: Draw a DC load line for the base bias circuit neglecting V_{be}

```

7 Vcc=24
8 Rb=390*10^3
9 Rc=3.3*10^3
10 Vce=10
11 //Find Ic
12 Ic=(Vcc-Vce)/Rc //from circuit
13 //find Ib
14 Ib=(Vcc-Vbe)/Rb //from circuit
15 //the value of hFE
16 hFE=Ic/Ib
17 //to find Vce when hFE=100
18 hFE1=100
19 Ic1=hFE1*Ib
20 Vce1=Vcc-(Ic1*Rc)
21 printf("Value of hFE is \n%f\n",hFE)
22 printf("New value of Vce is \n%f volt\n",Vce1)

```

Scilab code Exa 3.3.57 Design a Base bias circuit

```

1 clc
2 disp("Example 3.57")
3 printf("\n")
4 disp("Design a Base bias circuit")
5 printf("Given\n")
6 //given
7 Vce=5
8 Ic=5*10^-3
9 Vcc=15
10 hFE=100
11 //Value of Rc
12 Rc=(Vcc-Vce)/Ic
13 Ib=Ic/hFE
14 //value of Rb
15 Vbe=0.7
16 Rb=(Vcc-Vbe)/Ib

```



```
17 printf("The value of Rc=%f ohm\nRb=%f ohm\n",Rc ,Rb)
```

Scilab code Exa 3.3.58 Draw the DC load line and determine Rc for base bias circuit

```
1 clc
2 disp("Example 3.58")
3 printf("\\n")
4 disp("Draw the DC load line & determine Rc for base
    bias circuit")
5 printf("Given\\n")
6 //given
7 Vcc=18
8 Vbe=0.7
9 Vceq=9
10 Icq=2*10^-3
11 //to find Rc
12 Rc=(Vcc-Vceq)/Icq //from circuit
13 //to draw DC load line
14 Ic1=Vcc/Rc
15 Vce=[Vcc Vceq 0]
16 Ic=[0 Icq Ic1]
17 printf("Q(%f volt ,%f ampere)\\n",Vceq,Icq)
18 plot2d(Vce, Ic)
19 xlabel("Vce in volt")
20 ylabel("Ic in ampere")
21 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.59 Calculate Base resistance for base bias circuit

```
1 clc
```

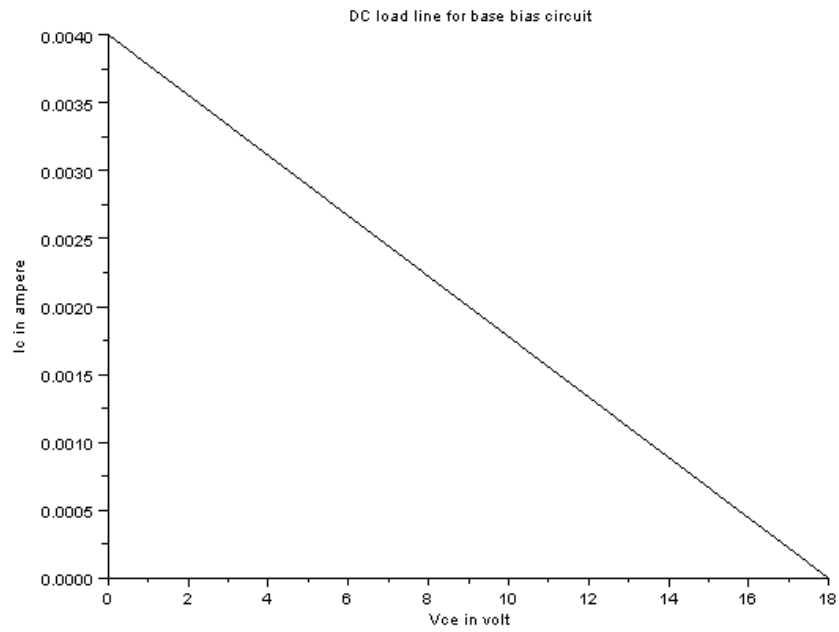


Figure 3.8: Draw the DC load line and determine R_c for base bias circuit

```

2 disp("Example 3.59")
3 printf("\n")
4 disp("Calculate Base resistance for base bias
      circuit")
5 printf("Given\n")
6 //given
7 Vcc=20
8 Vce=5
9 Rc=6.8*10^3
10 hFE=120
11 Vbe=0.7
12 //collector current
13 Ic=(Vcc-Vce)/Rc
14 //base current
15 Ib=Ic/hFE
16 //the required base resistance
17 Rb=(Vcc-Vbe)/Ib
18 printf("The base resistance \n%f ohm\n",Rb)

```

Scilab code Exa 3.3.61 Determine the I_c and V_{ce} levels and draw DC load line for Collector to base bias

```

1 clc
2 disp("Example 3.61")
3 printf("\n")
4 disp("Determine the  $I_c$  &  $V_{ce}$  levels & draw DC load
      line for Collector to base bias")
5 printf("Given\n")
6 //given
7 Vcc=15
8 Vbe=0.7
9 hFE=50
10 Rc=1.8*10^3
11 Rb=39*10^3
12 //base current

```

```

13 Ib=(Vcc-Vbe)/(Rb+(1+hFE)*Rc)
14 //collector current
15 Icq=hFE*Ib
16 //value of Vce
17 Vceq=(Ib*Rb)+Vbe
18 //to draw DC load line
19 Ic1=Vcc/Rc
20 Vce=[Vcc Vceq 0]
21 Ic=[0 Icq Ic1]
22 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
23 plot2d(Vce, Ic)
24 xlabel("Vce in volt")
25 ylabel("Ic in ampere")
26 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.62 Determine the hFE and new Vce for hFE is 50 for Collector to base bias

```

1 clc
2 disp("Example 3.62")
3 printf("\n")
4 disp("Determine the hFE and new Vce for hFE=50 for
      Collector to base bias")
5 printf("Given\n")
6 //given
7 Vcc=15
8 Vce=5
9 Vbe=0.7
10 Rb=82*10^3
11 Rc=5.6*10^3
12 //base current
13 Ib=(Vce-Vbe)/Rb
14 //hFE value

```

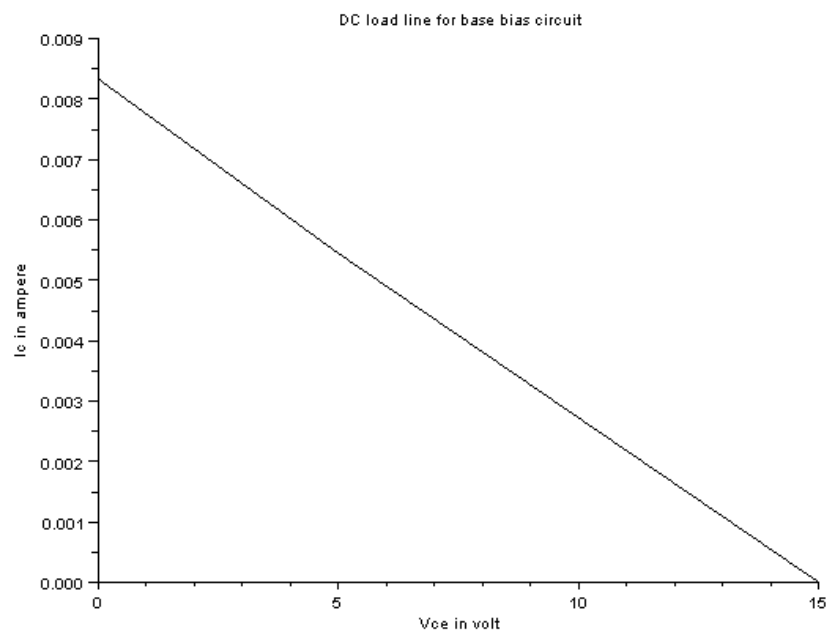


Figure 3.9: Determine the I_c and V_{ce} levels and draw DC load line for Collector to base bias

```

15 hFE=((Vcc-Vbe)/(Ib*Rc))-(Rb/Rc)-1
16 //to find Vce for hFE=50
17 hFE1=50
18 Ib1=(Vcc-Vbe)/(Rb+(1+hFE1)*Rc)
19 Vce1=(Ib1*Rb)+Vbe
20 printf("The hFE is \n%f\n",hFE)
21 printf("new Vce is \n%fvolt \n",Vce1)

```

Scilab code Exa 3.3.63 Draw a DC load line for Collector to base bias

```

1 clc
2 disp("Example 3.63")
3 printf("\n")
4 disp("Draw a DC load line for Collector to base bias
   ")
5 printf("Given\n")
6 //given
7 Vcc=20
8 Vbe=0.7
9 hFE=50
10 Rc=1.8*10^3
11 Rb=39*10^3
12 //base current
13 Ib=(Vcc-Vbe)/(Rb+(1+hFE)*Rc)
14 //collector current
15 Icq=hFE*Ib
16 //to find Vce
17 Vceq=(Ib*Rb)+Vbe
18 //to draw DC load line
19 Ic1=Vcc/Rc
20 Vce=[Vcc Vceq 0]
21 Ic=[0 Icq Ic1]
22 printf("Q(%f,%f)\n",Vceq,Icq)
23 plot2d(Vce, Ic)
24 xlabel("Vce")

```

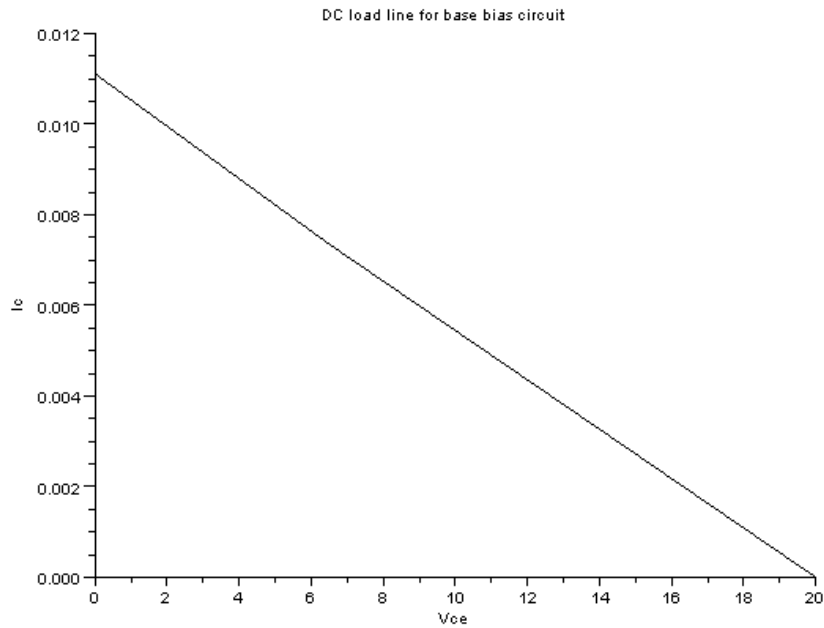


Figure 3.10: Draw a DC load line for Collector to base bias

```

25 ylabel("Ic")
26 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.64 Draw a DC load line for Collector to base bias for different hFE

```

1 clc
2 disp("Example 3.64")
3 printf("\n")
4 disp("Draw a DC load line for Collector to base bias
      for different hFE")

```

```

5 printf(" Given\n")
6 //given
7 Vcc=18
8 Vbe=0.7
9 hFE1=50
10 hFE2=200
11 Rc=2.2*10^3
12 Rb=270*10^3
13 //for hFE=50
14 //base current
15 Ib1=(Vcc-Vbe)/(Rb+(1+hFE1)*Rc)
16 //collector current
17 Icq1=hFE1*Ib1
18 //to find Vce
19 Vceq1=(Ib1*Rb)+Vbe
20 //for hFE=200
21 //base current
22 Ib2=(Vcc-Vbe)/(Rb+(1+hFE2)*Rc)
23 //collector current
24 Icq2=hFE2*Ib2
25 //to find Vce
26 Vceq2=(Ib2*Rb)+Vbe
27 //to draw DC load line
28 Ic1=Vcc/Rc
29 Vce=[Vcc Vceq1 Vceq2 0]
30 Ic=[0 Icq1 Icq2 Ic1]
31 printf("Q1(%f volt ,%f ampere)\n",Vceq1,Icq1)
32 printf("Q2(%f volt ,%f ampere)\n",Vceq2,Icq2)
33 plot2d(Vce, Ic)
34 xlabel("Vce in volt")
35 ylabel("Ic in ampere")
36 xtitle("DC load line for base bias circuit")

```

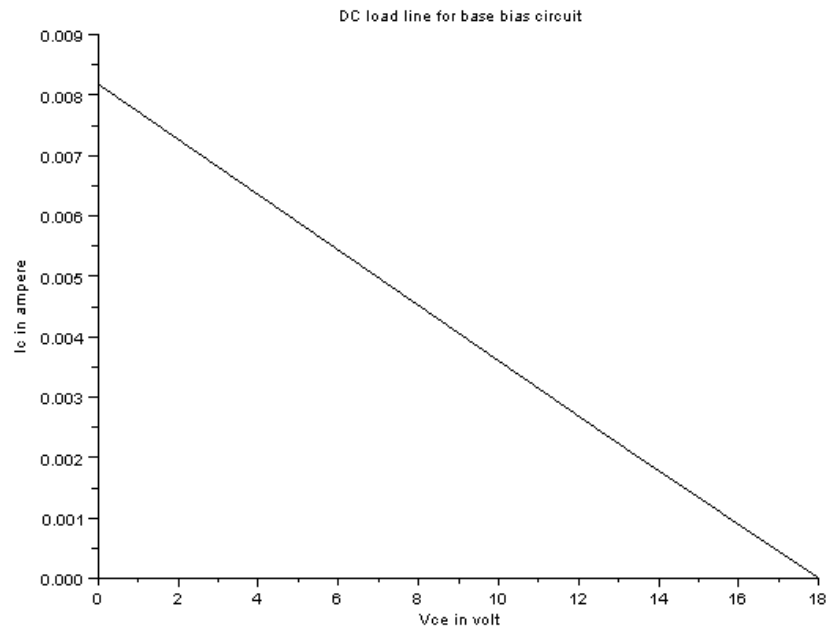


Figure 3.11: Draw a DC load line for Collector to base bias for different hFE

Scilab code Exa 3.3.66 Design a Collector to base bias circuit

```
1  clc
2  disp(" Example 3.66")
3  printf("\n")
4  disp(" Design a Collector to base bias circuit")
5  printf(" Given\n")
6  //Given
7  Vce=5
8  Ic=5*10^-3
9  Vbe=0.7
10 Vcc=15
11 hFE=100
12 //base current
13 Ib=Ic/hFE
14 //collector resistance
15 Rc=(Vcc-Vce)/(Ic+Ib)
16 //base resistance
17 Rb=(Vce-Vbe)/Ib
18 printf(" base current %f ampere \n",Ib)
19 printf(" Collector resistance %f ohm \n",Rc)
20 printf(" base resistance %f ohm \n",Rb)
```

Scilab code Exa 3.3.67 Design a Collector to base bias circuit

```
1  clc
2  disp(" Example 3.67")
3  printf("\n")
4  disp(" Design a Collector to base bias circuit")
5  printf(" Given\n")
6  //Given
7  Vce=10
8  Ic=3*10^-3
9  Vbe=0.7
10 Vcc=25
```

```

11 hFE=80
12 //base current
13 Ib=Ic/hFE
14 //collector resistance
15 Rc=(Vcc-Vce)/(Ic+Ib)
16 //base current
17 Rb=(Vce-Vbe)/Ib
18 printf("base current %f ampere \n",Ib)
19 printf("Collector resistance %f ohm \n",Rc)
20 printf("base resistance %f ohm \n",Rb)

```

Scilab code Exa 3.3.68 Calculate required base resistance for Collector to base bias circuit

```

1 clc
2 disp("Example 3.68")
3 printf("\n")
4 disp("Calculate required base resistance for
      Collector to base bias circuit")
5 printf("Given\n")
6 //given
7 Vcc=30
8 Vce=7
9 Vbe=0.7
10 Rc=8.2*10^3
11 hFE=100
12 //base current
13 Ib=(Vcc-Vce)/(Rc*(1+hFE))
14 //base resistance
15 Rb=(Vce-Vbe)/Ib
16 printf("base resistance is \n%f ohm\n",Rb)

```

Scilab code Exa 3.3.72 Draw a DC load line for Voltage divider circuit

```

1  clc
2  disp(" Example 3.72")
3  printf(" \n")
4  disp(" Draw a DC load line for Voltage divider
        circuit")
5  printf(" Given \n")
6  //given
7  Vcc=15
8  Rc=2.7*10^3
9  Re=2.2*10^3
10 R1=22*10^3
11 R2=12*10^3
12 Vbe=0.7
13 //base voltage
14 Vb=(Vcc*R2)/(R1+R2)
15 //emitter voltage
16 Ve=Vb-Vbe
17 //emitter current
18 Ie=Ve/Re
19 //collector current
20 Icq=Ie
21 //collector to emitter voltage
22 Vceq=Vcc-(Icq*(Rc+Re))
23 //collector voltage
24 Vc=Vce+Ve
25 //to draw DC load line
26 Ic1=Vcc/(Rc+Re)
27 Vce=[Vcc Vceq 0]
28 Ic=[0 Icq Ic1]
29 printf(" Q(%f volt ,%f ampere) \n",Vceq,Icq)
30 plot2d(Vce, Ic)
31 xlabel(" Vce in volt")
32 ylabel(" Ic in ampere")
33 xtitle("DC load line for base bias circuit")

```

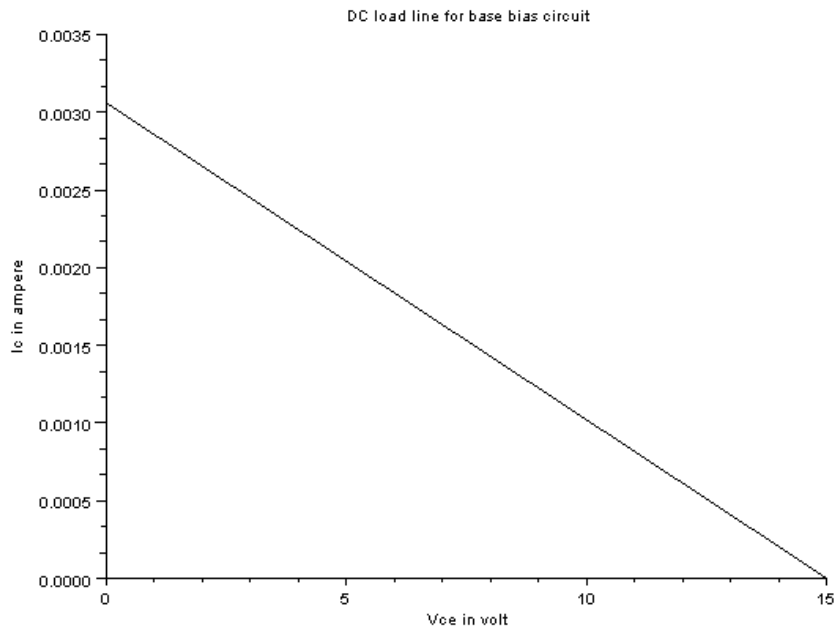


Figure 3.12: Draw a DC load line for Voltage divider circuit

Scilab code Exa 3.3.73 Find the V_e , I_c , V_{ce} and V_c and Draw a DC load line for Voltage divider circuit

```
1  clc
2  disp("Example 3.73")
3  printf("\n")
4  disp("Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  &  $V_c$ . Draw a DC load line
      for Voltage divider circuit")
5  printf("Given\n")
6  //given
7  Vcc=18
8  Vbe=0.7
9  hFE=50
10 R1=33*10^3
11 R2=12*10^3
12 Rc=1.2*10^3
13 Re=10^3
14 //thevenin voltage
15 Vt=(Vcc*R2)/(R1+R2)
16 //thevenin resistance
17 Rt=(R1*R2)/(R1+R2)
18 //base current
19 Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
20 //collector current
21 Icq=hFE*Ib
22 //emitter current
23 Ie=Ib+Icq
24 //emitter voltage
25 Ve=Ie*Re
26 //collector to emitter voltage
27 Vceq=Vcc-(Icq*Rc)-(Ie*Re)
28 //collector voltage
29 Vc=Vce+Ve
30 //to draw DC load line
```

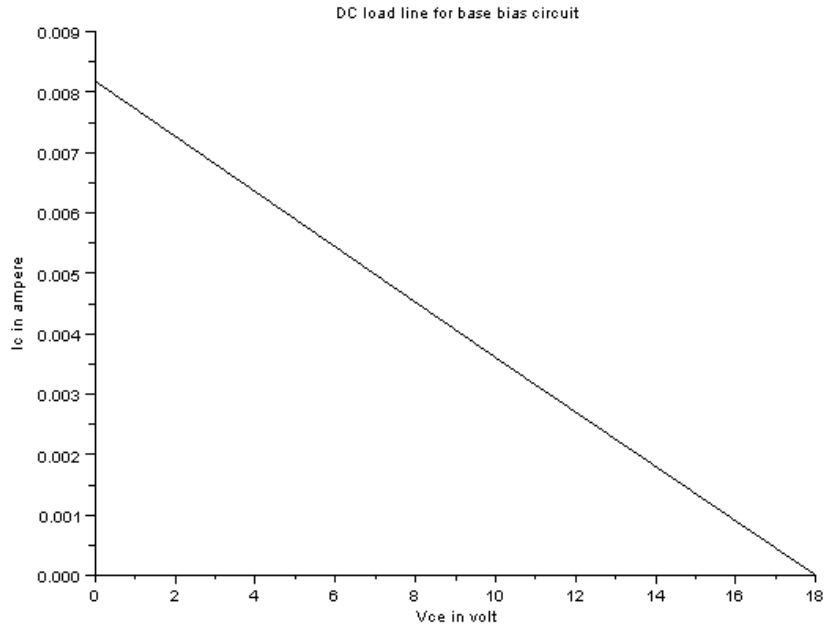


Figure 3.13: Find the V_e I_c V_{ce} and V_c and Draw a DC load line for Voltage divider circuit

```

31 Ic1=Vcc/(Rc+Re)
32 Vce=[Vcc Vceq 0]
33 Ic=[0 Icq Ic1]
34 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
35 plot2d(Vce, Ic)
36 xlabel("Vce in volt")
37 ylabel("Ic in ampere")
38 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.74 Find the V_e I_c V_{ce} and V_c and Draw a DC load

line for Voltage divider circuit

```
1 clc
2 disp("Example 3.74")
3 printf("\n")
4 disp("Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  &  $V_c$ . Draw a DC load line
   for Voltage divider circuit")
5 printf("Given\n")
6 //given
7 Vcc=15
8 Vbe=0.7
9 hFE=50
10 R1=6.8*10^3
11 R2=3.3*10^3
12 Rc=0.9*10^3
13 Re=0.9*10^3
14 //thevenin voltage
15 Vt=(Vcc*R2)/(R1+R2)
16 //thevenin resistance
17 Rt=(R1*R2)/(R1+R2)
18 //base current
19 Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
20 //collector current
21 Icq=hFE*Ib
22 //emitter current
23 Ie=Ib+Icq
24 //emitter voltage
25 Ve=Ie*Re
26 //collector to emitter voltage
27 Vceq=Vcc-(Icq*Rc)-(Ie*Re)
28 //collector voltage
29 Vc=Vce+Ve
30 //to draw DC load line
31 Ic1=Vcc/(Rc+Re)
32 Vce=[Vcc Vceq 0]
33 Ic=[0 Icq Ic1]
34 printf("Q(%f,%f)\n",Vceq,Icq)
35 plot2d(Vce, Ic)
```

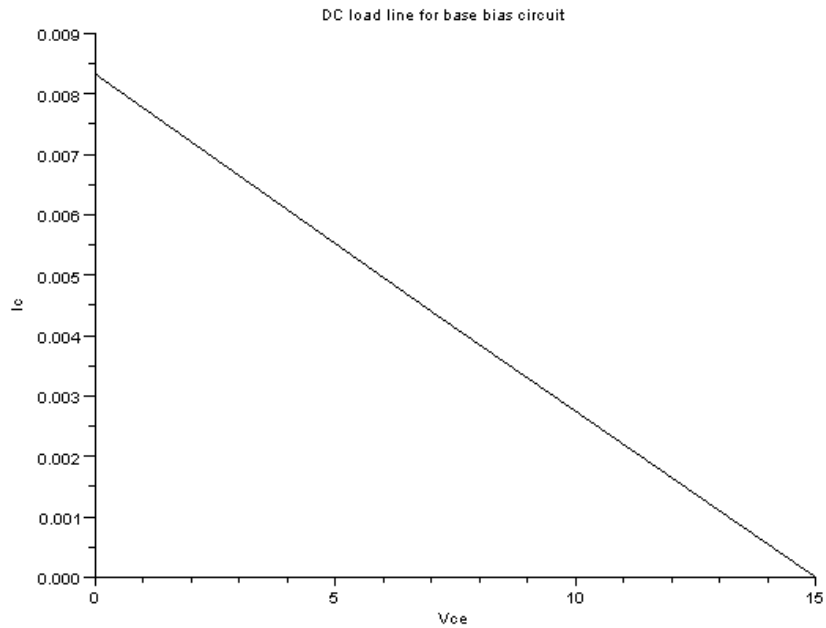



Figure 3.14: Find the V_e I_c V_{ce} and V_c and Draw a DC load line for Voltage divider circuit

```

36 xlabel("Vce")
37 ylabel("Ic")
38 xtitle("DC load line for base bias circuit")

```

Scilab code Exa 3.3.76 Design a Voltage divider bias circuit

```

1 clc
2 disp("Example 3.76")
3 printf("\n")
4 disp("Design a Voltage divider bias circuit")

```

```

5 printf(" Given\n")
6 //given
7 Vce=5
8 Ve=Vce
9 Ic=5*10^-3
10 Vcc=15
11 hFE=100
12 Vbe=0.7
13 //emitter resistance
14 Re=Ve/Ic
15 //collector resistance
16 Rc=(Vcc-Vce-Ve)/Ic
17 //current through resistor R2
18 I2=Ic/10
19 //base voltage
20 Vb=Vbe+Ve
21 //resistance 1
22 R1=(Vcc-Vb)/I2
23 //resistance 2
24 R2=Vb/I2
25 printf(" Collector resistance %f ohm \n",Rc)
26 printf(" emitter resistance %f ohm \n",Re)
27 printf(" base voltage %f volt \n",Vb)
28 printf(" voltage divider resistance R1 & R2 %f ohm\n
    %f ohm\n",R1,R2)

```

Scilab code Exa 3.3.77 Design a Voltage divider bias circuit

```

1 clc
2 disp(" Example 3.77")
3 printf("\n")
4 disp(" Design a Voltage divider bias circuit")
5 printf(" Given\n")
6 //given
7 Vce=3

```

```

8 Ve=5
9 Ic=10^-3
10 Vcc=12
11 Vbe=0.7
12 //emitter resistance
13 Re=Ve/Ic
14 //collector resistance
15 Rc=(Vcc-Vce-Ve)/Ic
16 //current through resistor R2
17 I2=Ic/10
18 //base voltage
19 Vb=Vbe+Ve
20 //resistance 1
21 R1=(Vcc-Vb)/I2
22 //resistance 2
23 R2=Vb/I2
24 printf(" Collector resistance %f ohm \n",Rc)
25 printf(" emitter resistance %f ohm \n",Re)
26 printf(" base voltage %f volt \n",Vb)
27 printf(" voltage divider resistance R1 & R2 %f ohm\n
%f ohm\n",R1,R2)

```

Scilab code Exa 3.3.79 Calculate the suitable resistor values for Voltage divider bias circuit

```

1 clc
2 disp(" Example 3.79")
3 printf("\n")
4 disp(" Calculate the suitable resistor values for
Voltage divider bias circuit")
5 printf(" Given\n")
6 printf(" 1 Resistance are in ohms \n2 Current are in
ampere \n3 voltage sources are in volt")
7 //given
8 Vcc=20

```

```

9 Vce=8
10 hFE=80
11 Vbe=0.7
12 Rc=6*10^3
13 //select Ve
14 Ve=5
15 //find collector resistor
16 Ic=(Vcc-Vce-Ve)/Rc
17 //find I2
18 I2=Ic/10
19 //emitter resistance
20 Re=Ve/Ic
21 //base voltage
22 Vb=Vbe+Ve
23 //resistance R1
24 R1=(Vcc-Vb)/I2
25 //resistance R2
26 R2=Vb/I2
27 printf("Collector resistance %f ohm \n",Rc)
28 printf("emitter resistance %f ohm \n",Re)
29 printf("base voltage %f volt \n",Vb)
30 printf("voltage divider resistance R1 & R2 %f ohm\n
%f ohm\n",R1,R2)

```

Scilab code Exa 3.3.85 Find the stability factor and change in I_c for increase in temperature of base bias circuit

```

1 clc
2 disp("Example 3.85")
3 printf("\n")
4 disp("Find the stability factor & change in  $I_c$  for
increase in temperature of base bias circuit")
5 printf("Given\n")
6 //given
7 hFE=100

```

```

8 Rc=2.2*10^3
9 Rb=470*10^3
10 Icbo1=15*10^-9
11 T1=25
12 T2=105
13 //stability factor
14 S=1+hFE
15 //Change in collector to base reverse saturation
    current(delIcbo)
16 n=(T2-T1)/10
17 Icbo2=Icbo1*2^8
18 delIcbo=Icbo2-Icbo1
19 //Change in Ic for increase in temperature
20 delIc=S*delIcbo
21 printf("Stability factor is \n%f\n",S)
22 printf("the change in collector current is \n%f
    ampere\n",delIc)

```

Scilab code Exa 3.3.86 Find the stability factor and change in I_c for increase in temperature of collector to base bias circuit

```

1 clc
2 disp("Example 3.86")
3 printf("\n")
4 disp("Find the stability factor & change in Ic for
    increase in temperature of collector to base bias
    circuit")
5 printf("Given\n")
6 //given
7 hFE=100
8 Rc=2.2*10^3
9 Rb=270*10^3
10 Icbo1=15*10^-9
11 T1=25
12 T2=105

```

```

13 //stability factor
14 S=(1+hFE)/(1+((hFE*Rc)/(Rc+Rb)))
15 //Change in collector to base reverse saturation
    current(delIcbo)
16 n=(T2-T1)/10
17 Icbo2=Icbo1*2^8
18 delIcbo=Icbo2-Icbo1
19 //Change in Ic for increase in temperature
20 delIc=S*delIcbo
21 printf("stability factor %f \n",S)
22 printf("change in Ic %f ampere\n",delIc)

```

Scilab code Exa 3.3.87 Find the stability factor and change in I_c for increase in temperature of Voltage divider bias circuit

```

1 clc
2 disp("Example 3.87")
3 printf("\n")
4 disp("Find the stability factor & change in Ic for
    increase in temperature of Voltage divider bias
    circuit")
5 printf("Given\n")
6 //given
7 hFE=100
8 Rc=1.2*10^3
9 R1=33*10^3
10 R2=12*10^3
11 Re=10^3
12 Icbo1=15*10^-9
13 T1=25
14 T2=105
15 //thevenin resistance
16 Rt=(R1*R2)/(R1+R2)
17 //stability factor
18 S=(1+hFE)/(1+((hFE*Re)/(Re+Rt)))

```

```

19 //Change in collector to base reverse saturation
    current(delIcbo)
20 n=(T2-T1)/10
21 Icbo2=Icbo1*2^8
22 delIcbo=Icbo2-Icbo1
23 //Change in Ic for increase in temperature
24 delIc=S*delIcbo
25 printf("stability factor %f \n",S)
26 printf("change in Ic %f ampere\n",delIc)

```

Scilab code Exa 3.3.89 Calculate the change in I_c produced by effect of V_{be} changes over temperature of Voltage divider bias circuit

```

1 clc
2 disp("Example 3.89")
3 printf("\n")
4 disp("Calculate the change in Ic produced by effect
    of Vbe changes over temperature of Voltage
    divider bias circuit")
5 printf("Given\n")
6 //given
7 Re=4.7*10^3
8 T1=25
9 T2=125
10 //change in temperature
11 delT=T2-T1
12 //change in Vbe
13 delVbe=delT*(-1.8*10^-3) //change in Vbe for 1C
    raise in temperature=-1.8mV/C
14 //change in Ic
15 delIc=-delVbe/Re
16 printf("change in Ic %f ampere\n",delIc)

```

Scilab code Exa 3.3.90 Calculate the change in I_c produced by effect of V_{be} changes over temperature of Voltage divider bias circuit

```
1 clc
2 disp("Example 3.90")
3 printf("\n")
4 disp("Calculate the change in  $I_c$  produced by effect
      of  $V_{be}$  changes over temperature of Voltage
      divider bias circuit")
5 printf("Given\n")
6 //given
7 Re=4.7*10^3
8 T1=-35
9 T2=100
10 //change in temperature
11 delT=T2-T1
12 //change in  $V_{be}$ 
13 delVbe=delT*(-1.8*10^-3) //change in  $V_{be}$  for 1C
      raise in temperature=-1.8mV/C
14 //change in  $I_c$ 
15 delIc=-delVbe/Re
16 printf("The change in IC is \n%f ampere\n",delIc)
```

Chapter 4

Other Devices

Scilab code Exa 4.4.18 Calculate input voltage that turns SCR ON and supply voltage that turns OFF

```
1  clc
2  disp("Example 4.18")
3  printf("\n")
4  disp("Calculate input voltage that turns SCR ON, &
      find supply voltage that turns SCR OFF if holding
      current is 10mA")
5  printf("Given\n")
6  printf("Resistance are in ohms \nCurrent are in
      Ampere \n Voltage sources are in volt\n")
7  //gate trigger voltage
8  Vgt=0.75
9  //trigger current
10 Igt=5*10^-3
11 //gate resistance
12 Rg=1000
13 //load resistance
14 RL=100
15 //diode forward voltage
16 Vf=0.7
17 //holding current
```

```

18 Ih=10*10^-3
19 //minimum input voltage to trigger the SCR is
20 Vin=Vgt+(Igt*Rg)
21 //The supply voltage that turns OFF the SCR is
22 VCC=Vf+(Ih*RL)
23 printf("minimum input voltage to trigger the SCR is
    %f volt \n",Vin)
24 printf("The supply voltage that turns OFF the SCR is
    %f volt \n",VCC)

```

Scilab code Exa 4.4.28 Calculate the values of R1 R2 and Rp of SCR circuit

```

1 clc
2 disp("Example 4.28")
3 printf("\n")
4 disp("Calculate suitable values of R1,Rp,R2 for SCR
    in circuit Fig 4.12")
5 printf("Given\n")
6 printf("Resistance are in ohms \nCurrent are in
    Ampere \n Voltage sources are in volt\n")
7 //gate current
8 Ig=250*10^-6
9 //gate trigger voltage
10 Vgt=0.75
11 Vd=0.7
12 //supply voltage
13 Vs=40
14 //peak value of supply voltage
15 Vm=sqrt(2)*Vs
16 //supply voltage at angle 10deg
17 Vs1=Vm*sin(10*%pi/180)
18 //supply voltage at angle 90deg
19 Vs2=Vm*sin(90*%pi/180)
20 Vt=Vd+Vgt

```

```

21 //to trigger SCR at 10deg moving contact of Rp is at
    top
22 //from circuit
23 VR1=Vs1-Vt
24 //choose I1min>>Ig
25 I1min=1.5*10^-3
26 R1=VR1/I1min
27 //since Ig<<I1min, current through Rp & R2 is I1min
28 RpPLUSR2=Vt/I1min
29 //to trigger SCR at 90deg moving contact of Rp is at
    bottom
30 VR2=Vt
31 I1=Vs2/(R1+RpPLUSR2)
32 R2=Vt/I1
33 Rp=RpPLUSR2-R2
34 printf("Resistance R1 is %f ohm \n",R1)
35 printf("Resistance R2 is %f ohm \n",R2)
36 printf("Resistance Rp is %f ohm \n",Rp)

```

Scilab code Exa 4.4.29 Calculate the values of R1 R2 and Rp of SCR circuit

```

1 clc
2 disp("Example 4.29")
3 printf("\n")
4 disp("Calculate suitable values of R1,Rp,R2 for SCR
    in circuit Fig 4.12")
5 printf("Given\n")
6 printf("Resistance are in ohms \nCurrent are in
    Ampere \n Voltage sources are in volt\n")
7 //gate current
8 Ig=600*10^-6
9 //gate trigger voltage
10 Vg=0.7
11 Vd=0.7

```

```

12 //supply voltage
13 Vs=230
14 //peak value of supply voltage
15 Vm=sqrt(2)*Vs
16 //supply voltage at angle 8deg
17 Vs1=Vm*sin(8*%pi/180)
18 //supply voltage at angle 90deg
19 Vs2=Vm*sin(90*%pi/180)
20 //to trigger SCR at 10deg moving contact of Rp is at
    top
21 //from circuit
22 VR1=Vs1-Vg
23 //choose I1min>>Ig
24 I1min=6*10^-3
25 R1=VR1/I1min
26 //since Ig<<I1min, current through Rp & R2 is I1min
27 RpPLUSR2=Vg/I1min
28 //to trigger SCR at 90deg moving contact of Rp is at
    bottom
29 VR2=Vt
30 I1=Vs2/(R1+RpPLUSR2)
31 R2=Vg/I1
32 Rp=RpPLUSR2-R2
33 printf("Resistance R1 is %f ohm \n",R1)
34 printf("Resistance R2 is %f ohm \n",R2)
35 printf("Resistance Rp is %f ohm \n",Rp)

```

Scilab code Exa 4.4.40 Design the SCR crowbar circuit to protect the load from voltage levels greater than 12V

```

1 clc
2 disp("Example 4.40")
3 printf("\n")
4 disp("Design the SCR crowbar circuit to protect the
    load from voltage levels greater than 12V")

```

```

5 printf(" Given\n")
6 //gate trigger voltage
7 Vgt=0.75
8 //load voltage maximum
9 VLmax=12
10 //Zener voltage is
11 Vz=VLmax-Vgt
12 //assume zener current(mini) as
13 Izmin=10^-3
14 R=Vgt/Izmin
15 printf(" zener voltage \n%f volt\n",Vz)
16 printf(" Resistance \n%f ohm\n",R)

```

Scilab code Exa 4.4.41 Design the SCR crowbar circuit to protect the load from voltage levels greater than specified voltage

```

1 clc
2 disp(" Example 4.41 ")
3 printf("\n")
4 disp(" Design the SCR crowbar circuit to protect the
      load from voltage levels greater than 7.5V")
5 printf(" Given\n")
6 //gate trigger voltage
7 Vgt=0.7
8 //load voltage maximum
9 VLmax=7.5
10 //Zener voltage is
11 Vz=VLmax-Vgt
12 //assume zener current(mini) as
13 Izmin=10^-3
14 R=Vgt/Izmin
15 printf(" zener voltage \n%f volt\n",Vz)
16 printf(" Resistance \n%f ohm\n",R)

```

Scilab code Exa 4.4.49 Determine the minimum and maximum triggering voltage for a UJT

```
1 clc
2 disp("Example 4.49")
3 printf("\\n")
4 disp("Determine the minimum & maximum triggering
      voltage for a UJT")
5 printf("Given\\n")
6 Vbb=20
7 //intrinsic ratios
8 nmin=0.6
9 nmax=0.8
10 V=0.7
11 //minimum triggering voltage is
12 Vpmini=nmin*Vbb+Vd
13 //maximum triggering voltage is
14 Vpmax=nmax*Vbb+Vd
15 printf("Minimum triggering Voltage \\n%f volt\\n",
      Vpmini)
16 printf("Maximum triggering Voltage \\n%f volt\\n",
      Vpmax)
```

Scilab code Exa 4.4.51 find maximum oscillating frequency of UJT

```
1 clc
2 disp("Example 4.51")
3 printf("\\n")
4 disp("Calculate minimum & maximum values of Re for
      the relaxation oscillator & also find maximum
      oscillating frequency")
5 printf("Given\\n")
```

```

6 Vbb=15
7 //the parameters of UJT
8 Ip=10^-6
9 Iv=2.5*10^-3
10 Vv=2.5
11 n=0.7
12 PRe=20*10^3
13 C=10^-6
14 Vp=12
15 Vd=0.7
16 Vp1=(n*Vbb)+Vd
17 //minimum Re
18 Remin=(Vbb-Vv)/Iv
19 //maximum Re
20 Remax=(Vbb-Vp1)/Ip
21 //to find maximum oscillating frequency
22 T=PRe*C*log((Vbb-Vv)/(Vbb-Vp))
23 f=1/T
24 printf("maximum Re \n%f ohm\n",Remax)
25 printf("minimum Re \n%f ohm\n",Remin)
26 printf("maximum oscillating frequency \n%f hz \n",f)

```

Scilab code Exa 4.4.52 Determine the minimum and maximum values of VEB1 for a UJT

```

1 clc
2 disp("Example 4.52")
3 printf("\n")
4 disp("Determine the minimum & maximum values of VEB1
      for a UJT")
5 printf("Given\n")
6 Vbb=15
7 //intrinsic ratios
8 nmin=0.68
9 nmax=0.82

```

```

10 V=0.7
11 //mini triggering voltage is
12 Vpmini=nmin*Vbb+Vd
13 //max triggering voltage is
14 Vpmax=nmax*Vbb+Vd
15 printf("minimum triggering voltage \n%f volt\n",
        Vpmini)
16 printf("maximum triggering voltage \n%f volt\n",
        Vpmax)

```

Scilab code Exa 4.4.53 find maximum oscillating frequency of UJT

```

1  clc
2  disp("Example 4.53")
3  printf("\n")
4  disp("find maximum oscillating frequency")
5  Vbb=20
6  //the parameters of UJT
7  Ip=10^-6
8  Iv=10*10^-3
9  Vv=3.5
10 n=0.75
11 PRe=4.7*10^3
12 C=0.5*10^-6
13 Vd=0.7
14 Vp1=(n*Vbb)+Vd
15 //to find maximum oscillating frequency
16 T=PRe*C*log((Vbb-Vv)/(Vbb-Vp1))
17 f=1/T
18 printf("Oscillator frequency \n%f hz\n",f)

```

Scilab code Exa 4.4.74 plot the drain characteristics of JFET

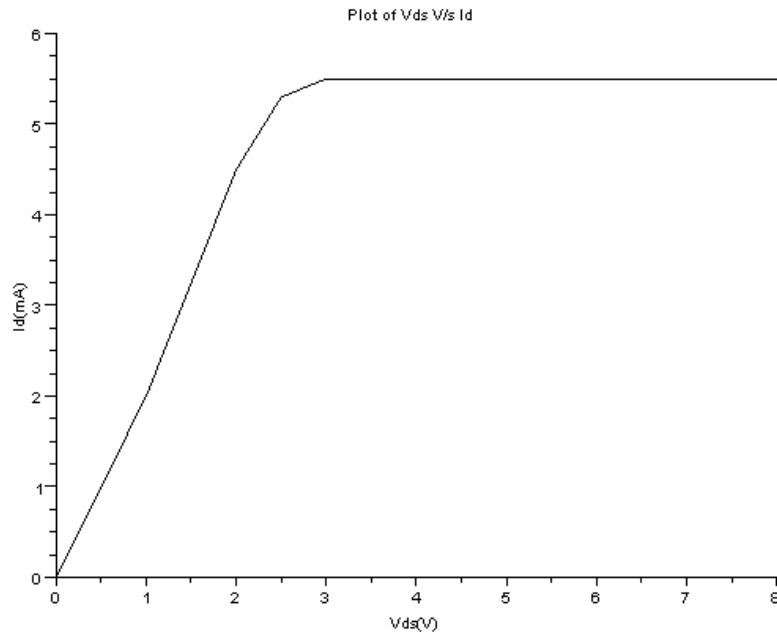


Figure 4.1: plot the drain characteristics of JFET

```

1  clc
2  disp(" Example 4.74")
3  printf(" \n")
4  disp(" plot the drain characteristics of JFET")
5  //given
6  Vds=[0 1 2 2.5 3 4 6 8]
7  Id=[0 2 4.5 5.3 5.5 5.5 5.5 5.5]
8  plot2d(Vds, Id)
9  xlabel(" Vds(V)")
10 ylabel(" Id(mA)")
11 xtitle(" Plot of Vds V/s Id")

```

Scilab code Exa 4.4.77 calculate V_{ds} at these gate source voltages and circuit voltage gain of JFET

```
1  clc
2  disp("Example 4.77")
3  printf("\n")
4  disp("calculate  $V_{ds}$  at these gate_source voltages &
      circuit voltage gain of JFET")
5  printf("Given\n")
6  //drain current
7  Id=9*10^-3
8  //gate to source voltage
9  Vgs=(-2)
10 //when Vgs is reduced to -1V then Id is 12mA
11 Vgs1=-1
12 Id1=12*10^-3
13 //from circuit (fig 4.49)
14 Rd=1.5*10^3
15 Vdd=20
16 //to find  $V_{ds}$ 
17 //when Vgs=-2
18 Vds=Vdd-(Id*Rd)
19 //when Vgs=-1
20 Vds1=Vdd-(Id1*Rd)
21 //change in input voltage Vgs is
22 delVi=Vgs1-Vgs
23 //change in output voltage is
24 delVo=Vds-Vds1
25 //Voltage gain
26 Av=delVo/delVi
27 printf("The value of  $V_{ds}$  at gate-source voltages is
      \n%f volt\n",Vds)
28 printf("The circuit voltage gain \n%f\n",Av)
```

Scilab code Exa 4.4.78 calculate the minimum and maximum variation in V_{ds} and circuit voltage gain of JFET

```
1  clc
2  disp("Example 4.78")
3  printf("\n")
4  disp("calculate the minimum & maximum variation in
       the drain source voltage  $V_{ds}$  produced by a change
       of 0.1V & circuit voltage gain of JFET")
5  printf("Given\n")
6  //transconductance
7  gmmax=5000*10^-6
8  gmmin=1500*10^-6
9  //change in gate to source voltage
10 delVgs=0.1
11 Rd=1.5*10^3
12 //the maximum change in drain current
13 delIdmax=gmmax*delVgs
14 delVdsmax=delIdmax*Rd
15 //voltage gain
16 Av1=delVdsmax/delVgs
17 //the minimum change in drain current
18 delIdmin=gmmin*delVgs
19 delVdsmin=delIdmin*Rd
20 //voltage gain
21 Av2=delVdsmin/delVgs
22 printf("maximum change in drain voltage is %f volt\n
       ",delVdsmax)
23 printf("maximum voltage gain %f \n",Av1)
24 printf("minimum change in drain voltage is %f volt\n
       ",delVdsmin)
25 printf("minimum voltage gain %f \n",Av2)
```

Scilab code Exa 4.4.79 calculate transconductance of JFET

```

1  clc
2  disp(" Example 4.79")
3  printf("\n")
4  disp(" calculate transconductance of JFET")
5  printf(" Given\n")
6  //voltage gain
7  Av=20
8  //drain resistance
9  Rd=3.3*10^3
10 //transconductance
11 gm=Av/Rd
12 printf(" Transconductance of JFET \n%f (1/ohm)\n", gm)

```

Scilab code Exa 4.4.80 determine the suitable value of load resistor R_d of JFET

```

1  clc
2  disp(" Example 4.80")
3  printf("\n")
4  disp(" determine the suitable value of load resistor
      Rd of JFET")
5  printf(" Given\n")
6  //voltage gain
7  Av=10
8  //transconductance
9  gm=4500*10^-6
10 //load resistance
11 Rd=Av/gm
12 printf(" load resistance \n%f ohm \n", Rd)

```

Chapter 5

Amplifiers and Oscillators

Scilab code Exa 5.5.3 Calculate output power change in decibel of amplifier

```
1  clc
2  disp("Example 5.3")
3  printf("\n")
4  disp("Calculate output power change in decibel of
      amplifier")
5  printf("Given\n")
6  //output power when frequency is 5khz
7  P1=50*10^-3
8  //output power when frequency is 20khz
9  P2=25*10^-3
10 //output power change in decibel
11 delPo=10*log10(P2/P1)
12 printf("output power change \n%f dB\n",delPo)
```

Scilab code Exa 5.5.4 Calculate output power change in decibel of amplifier

```

1  clc
2  disp(" Example 5.4")
3  printf("\n")
4  disp(" Calculate output power change in decibel of
      amplifier")
5  printf(" Given\n")
6  //output voltage of amplifier when frequency 3khz
7  V1=2
8  //output voltage of amplifier when frequency 50khz
9  V2=0.5
10 //output power change in decibel
11 delPo=20*log10(V2/V1)
12 printf("output power change \n%f dB\n",delPo)

```

Scilab code Exa 5.5.5 Calculate power gain of amplifier

```

1  clc
2  disp(" Example 5.5")
3  printf("\n")
4  disp(" Calculate power gain of amplifier")
5  printf(" Given\n")
6  //have equal input & load resistance
7  //input voltage
8  Vi=100*10^-3
9  //output voltage
10 Vo=3
11 //power gain of amplifier
12 Apdb=20*log10(Vo/Vi)
13 printf("power gain of amplifier \n%f\n",Apdb)

```

Scilab code Exa 5.5.6 Calculate new level of output voltage when it has fallen by 4db

```

1  clc
2  disp(" Example 5.6 ")
3  printf("\n")
4  disp(" Calculate new level of output voltage when it
      has fallen by 4db")
5  printf(" Given\n")
6  //output voltage of an amplifier is 2V when
      frequency 1khz
7  V1=2
8  //power in db
9  Po=-4
10 //new level of output voltage
11 V2=10^(Po/20)*V1
12 printf("new output voltage \n%f volt\n",V2)

```

Scilab code Exa 5.5.10 Calculate overall voltage gain and output voltage when input voltage is 1uV for cascaded amplifier

```

1  clc
2  disp(" Example 5.10 ")
3  printf("\n")
4  disp(" Calculate overall voltage gain in db & output
      voltage when input voltage is 1uV for cascaded
      amplifier")
5  printf(" Given\n")
6  //Voltage gain of amplifier
7  Av1=10
8  Av2=100
9  Av3=1000
10 //input voltage
11 Vi=10^-6
12 //overall voltage gain
13 Av=Av1*Av2*Av3
14 //in db
15 Avdb=20*log10(Av)

```

```

16 //output voltage when input voltage is  $10^{-6}V$ 
17 Vo=Av*Vi
18 printf("overall voltage gain in dB \n%f dB\n",Avdb)
19 printf("output voltage \n%f volt\n",Vo)

```

Scilab code Exa 5.5.11 Calculate overall voltage gain in db of cascaded 2 stage amplifier

```

1 clc
2 disp("Example 5.11")
3 printf("\n")
4 disp("Calculate overall voltage gain in db of
   cascaded 2 stage amplifier")
5 printf("Given\n")
6 //Voltage gain
7 Av1=10
8 Av2=20
9 //overall voltage gain
10 Av=Av1*Av2
11 //in db
12 Avdb=20*log10(Av)
13 printf("Overall gain is \n%f dB\n",Avdb)

```

Scilab code Exa 5.5.12 Calculate overall voltage gain and gain of 2nd and 3rd stage and input voltage of 2nd stage

```

1 clc
2 disp("Example 5.12")
3 printf("\n")
4 disp("Calculate overall voltage gain ,gain of 2nd &
   3rd stage ,input voltage of 2nd stage & all in db
   of three stage amplifier")
5 printf("Given\n")

```



```

6 //input voltage
7 Vi=0.05
8 //output voltage
9 Vo=150
10 //voltage gain of 1st stage
11 Av1=20
12 //input to 3rd stage
13 V2=15
14 //overall voltage gain
15 Av=Vo/Vi
16 //input to 2nd stage
17 V1=Av1*Vi
18 //voltage gain of 2nd stage
19 Av2=V2/V1
20 //voltage gain of 3rd stage
21 Av3=Vo/V2
22 //all stages gain in db
23 Av1db=20*log10(Av1)
24 Av2db=20*log10(Av2)
25 Av3db=20*log10(Av3)
26 //overall gain in db
27 Av=Av1db+Av2db+Av3db
28 printf("overall voltage gain \n%f\n",Av)
29 printf("voltage gain of 2nd & 3rd stages \n%f\n%f\n"
,Av2,Av3)
30 printf("input voltage of 2nd stage \n%f volt\n",V1)
31 printf("Decibal voltage gain of 1st, 2nd, 3rd stage
\n%fdB\n%fdB\n%fdB\n",Av1db,Av2db,Av3db)
32 printf("Overall gain in db \n%f dB\n",Av)

```

Scilab code Exa 5.5.15 For CE amplifier find R1 R2 Re and Rc

```

1 clc
2 disp("Example 5.15")
3 printf("\n")

```

```

4 disp("For CE amplifier shown in fig 5.5 find R1,R2,
      Re & Rc")
5 printf("Given\n")
6 Vcc=24
7 //load resistance
8 RL=120*10^3
9 //since Rc<<RL
10 Rc=RL/10
11 //select Ve & Vce
12 Ve=5
13 Vce=3
14 Vrc=Vcc-Vce-Ve //from circuit
15 Ic=Vrc/Rc
16 //find Re
17 Re=Ve/Ic
18 R2=10*Re
19 //Vbe for si transistor
20 Vbe=0.7
21 Vb=Vbe+Ve
22 I2=Vb/R2
23 R1=(Vcc-Vb)/I2
24 printf("The resistance values are\nR1=%f ohm\nR2=%f
      ohm\nRe=%f ohm\nRc=%f ohm\n",R1,R2,Re,Rc)

```

Scilab code Exa 5.5.16 For CE amplifier find R1 R2 Re and Rc

```

1 clc
2 disp("Example 5.16")
3 printf("\n")
4 disp("For CE amplifier shown in fig 5.5 find R1,R2,
      Re & Rc")
5 printf("Given\n")
6 Vcc=18
7 //load resistance
8 RL=56*10^3

```

```

 9 //since Rc<<RL
10 Rc=RL/10
11 //select Ve & Vce
12 Ve=5
13 Vce=3
14 Vrc=Vcc-Vce-Ve //from circuit
15 Ic=Vrc/Rc
16 //find Re
17 Re=Ve/Ic
18 R2=10*Re
19 //Vbe for si transistor
20 Vbe=0.7
21 Vb=Vbe+Ve
22 I2=Vb/R2
23 R1=(Vcc-Vb)/I2
24 printf("The resistance values are\nR1=%f ohm\nR2=%f
        ohm\nRe=%f ohm\nRc=%f ohm\n",R1 ,R2 ,Re ,Rc)

```

Scilab code Exa 5.5.19 calculate upper cutoff frequency and voltage gain at lower cutoff frequency

```

1 clc
2 disp(" Example 5.19")
3 printf("\n")
4 disp(" calculate upper cut-off frequency & voltage
        gain at lower cut-off frequency")
5 printf(" Given\n")
6 //bandwidth of amplifier
7 BW=500*10^3
8 //lower cut-off frequency
9 f1=25
10 //midband gain
11 Ao=120
12 //upper cut-off frequency
13 f2=BW+f1

```

```

14 //voltage gain at lower cut-off frequency
15 A1=Ao/sqrt(2)
16 printf("upper cut-off frequency \n %f hz\n",f2)
17 printf("Voltage gain at lower cut-off frequency \n
    %f \n",A1)

```

Scilab code Exa 5.5.23 calculate closed loop gain for the negative feedback amplifier

```

1 clc
2 disp("Example 5.23")
3 printf("\n")
4 disp("calculate closed-loop gain for the negative
    feedback amplifier")
5 printf("Given\n")
6 //voltage gain without feedback
7 Av=100000
8 //feedback factor
9 B=1/100
10 //voltage gain with feedback
11 Acl=Av/(1+(B*Av))
12 //when Av is changed by 50%
13 Av1=50*100000/100
14 Av2=Av+Av1
15 //voltage gain with feedback when Av changed by +50%
16 Acl1=Av2/(1+(B*Av2))
17 //voltage gain with feedback when Av changed by -50%
18 Av3=Av-Av1
19 Acl2=Av3/(1+(B*Av3))
20 printf("closed loop gain of negative feedback
    amplifier is \n %f \n",Acl2)

```

Scilab code Exa 5.5.24 calculate closed loop gain for the negative feedback amplifier

```
1 clc
2 disp("Example 5.24")
3 printf("\\n")
4 disp("calculate closed-loop gain for the negative
      feedback amplifier")
5 printf("Given\\n")
6 //voltage gain without feedback
7 Av=1000
8 //feedback factor
9 B=0.1
10 //voltage gain with feedback
11 Acl=Av/(1+(B*Av))
12 printf("closed loop gain of negative feedback
      amplifier is \\n %f \\n",Acl)
```

Scilab code Exa 5.5.27 calculate input impedance of amplifier with negative feedback

```
1 clc
2 disp("Example 5.27")
3 printf("\\n")
4 disp("calculate input impedance of amplifier with
      negative feedback")
5 printf("Given\\n")
6 //input impedance without feedback
7 Zb=10^3
8 //open loop voltage gain
9 Av=100000
10 //feedback network resistance
11 RF1=56*10^3
12 RF2=560
13 //input side resistance
```

```

14 R1=68*10^3
15 R2=33*10^3
16 //feedback factor
17 B=RF2/(RF1+RF2)
18 //input impedance with feedback
19 Zi=Zb*(1+(B*Av))
20 //input impedance with feedback by considering R1 &
    R2
21 Rp=(R1*R2)/(R1+R2)
22 Zin=(Zi*Rp)/(Zi+Rp)
23 printf("input impedance with negative feedback \n%f
    ohm\n",Zin)

```

Scilab code Exa 5.5.29 calculate input and output impedance of amplifier with negative feedback

```

1  clc
2  disp(" Example 5.29")
3  printf("\n")
4  disp(" calculate input & output impedance of
    amplifier with negative feedback")
5  printf(" Given\n")
6  //input impedance without feedback
7  Zb=10^3
8  //open loop voltage gain
9  Av=7533
10 //input side resistance
11 R1=68*10^3
12 R2=47*10^3
13 //feedback factor
14 B=1/101
15 //input impedance with feedback
16 Zi=Zb*(1+(B*Av))
17 //input impedance with feedback by considering R1 &
    R2

```

```

18 Rp=(R1*R2)/(R1+R2)
19 Zin=(Zi*Rp)/(Zi+Rp)
20 //output impedance without feedback
21 Zc=50*10^3
22 Rc=3.9*10^3
23 //output impedance with feedback
24 Zo=Zc/(1+(B*Av))
25 //output impedance with feedback by considering Rc
26 Zout=(Rc*Zo)/(Rc+Zo)
27 printf("input impedance with negative feedback \n%f
        ohm\n",Zin)
28 printf("output impedance with negative feedback \n%f
        ohm\n",Zout)

```

Scilab code Exa 5.5.35 Estimate the closed loop upper cut off frequency and total harmonic distortion

```

1 clc
2 disp("Example 5.35")
3 printf("\n")
4 disp("Estimate the closed loop upper cut-off
        frequency & total harmonic distortion")
5 printf("Given\n")
6 //open loop gain
7 Av=60000
8 //closed loop gain
9 Ac1=300
10 //open loop upper cut-off frequency
11 F20L=15*10^3
12 //closed loop upper cut-off frequency & Av/Ac1=(1+
        BAv)
13 F2CL=F20L*Av/Ac1
14 //total harmonic distortion with feedback if there
        is 10% distortion without feedback
15 HD=10/(Av/Ac1)

```

```

16 printf("closed loop upper cut-off frequency \n%f hz\n",F2CL)
17 printf("total harmonic distortion with feedback if there is 10per distortion without feedback \n%f\n",HD)

```

Scilab code Exa 5.5.36 calculate open loop cut off frequency if the open loop gain is 200000

```

1 clc
2 disp("Example 5.36")
3 printf("\n")
4 disp("calculate open loop cut-off frequency if the open loop gain is 200000")
5 printf("Given\n")
6 //open loop gain
7 Av=200000
8 //closed loop gain
9 Ac1=250
10 //upper cut-off frequency with feedback
11 F2CL=4*10^6
12 //upper cut-off frequency without feedback
13 F20L=F2CL/(Av/Ac1)
14 printf("upper cut-off frequency without feedback \n%f hz\n",F20L)

```

Scilab code Exa 5.5.37 calculate the phase shift with negative feedback

```

1 clc
2 disp("Example 5.37")
3 printf("\n")
4 disp("calculate the phase shift with negative feedback")

```



```

5 printf(" Given\n")
6 //open loop phase shift
7 Po=15
8 //open loop gain
9 Av=60000
10 //closed loop gain
11 Ac1=300
12 //to calculate phase shift with feedback
13 AvB=(Av/Ac1)-1
14 k=((AvB*sin(Po*pi/180))/(1+(AvB*cos(Po*pi/180))))
15 Pc1=Po-(atan(k)*180/pi)
16 printf("The phase shift with negative feedback=\t%f
        degree\n",Pc1)

```

Scilab code Exa 5.5.38 calculate bandwidth and gain and harmonic distortion with feedback

```

1 clc
2 disp(" Example 5.38")
3 printf("\n")
4 disp(" calculate bandwidth ,gain & harmonic distortion
        with feedback")
5 printf(" Given\n")
6 //open loop gain
7 Av=1000
8 //bandwidth without feedback
9 BWo1=500*10^3
10 //feedback factor
11 B=0.1
12 //bandwidth with feedback
13 BWc1=BWo1*(1+(B*Av))
14 //closed loop gain
15 Ac1=Av/(1+(B*Av))
16 //harmonic distortion if 15% negative feedback used
17 HDc1=15/(1+(B*Av))

```

```

18 printf("bandwidth with feedback is \n %f hz \n",BWc1
    )
19 printf("closed loop gain \n %f \n",Ac1)
20 printf("Harmonic distortion with feedback \n %f \n",
    HDc1)

```

Scilab code Exa 5.5.40 calculate the frequency of oscillation and feedback factor of Hartley oscillator

```

1  clc
2  disp("Example 5.50")
3  printf("\n")
4  disp("calculate the frequency of oscillation &
    feedback factor of Hartley oscillator")
5  printf("Given\n")
6  //inductance
7  L1=2*10^-3
8  L2=8*10^-3
9  //mutual inductance
10 M=100*10^-6
11 //capacitor
12 C=0.001*10^-6
13 //total inductance
14 L=L1+L2+M
15 //frequency of oscillation
16 f=1/(2*%pi*sqrt(L*C))
17 //feedback factor
18 B=L1/L2
19 printf("frequency of oscillation of hartley
    oscillator \n %f hz \n",f)
20 printf("feedback factor \n %f \n",B)

```

Scilab code Exa 5.5.43 calculate the frequency of oscillation of RC phase shift oscillator

```
1 clc
2 disp("Example 5.43")
3 printf("\n")
4 disp("calculate the frequency of oscillation of RC
   phase shift oscillator")
5 printf("Given\n")
6 R=500
7 C=0.1*10^-6
8 //frequency of oscillation
9 f=1/(2*pi*R*C*sqrt(6))
10 printf("frequency of oscillation \n%f hz\n",f)
```

Scilab code Exa 5.5.44 calculate the value of Capacitor for a RC phase shift oscillator

```
1 clc
2 disp("Example 5.44")
3 printf("\n")
4 disp("calculate the value of Capacitor for a RC
   phase shift oscillator")
5 printf("Given\n")
6 R=1000
7 //frequency of oscillation
8 f=5000
9 //capacitor value
10 C=1/(2*pi*R*f*sqrt(6))
11 printf("Capacitor value \n%e farad \n",C)
```

Scilab code Exa 5.5.45 calculate the value of R and C for RC phase shift oscillator

```

1  clc
2  disp(" Example 5.45")
3  printf("\n")
4  disp(" calculate the value of R & c for RC phase
      shift oscillator")
5  printf(" Given\n")
6  //oscillating frequency
7  f=2000
8  //select Capacitor value
9  C=0.1*10^-6
10 //resistance value
11 R=1/(2*%pi*f*C*sqrt(6))
12 printf(" Resistance value \n%f ohm\n",R)

```

Scilab code Exa 5.5.49 calculate frequency of oscillation and feedback factor and gain of hartley oscillator

```

1  clc
2  disp(" Example 5.49")
3  printf("\n")
4  disp(" calculate frequency of oscillation ,feedback
      factor & gain required for sustained oscillation
      of hartley oscillator")
5  printf(" Given\n")
6  //inductance
7  L1=5*10^-3
8  L2=10*10^-3
9  //capacitor
10 C=0.01*10^-6
11 //frequency of oscillation
12 f=1/(2*%pi*sqrt((L1+L2)*C))
13 //feedback factor
14 B=L1/L2
15 //gain required for sustained oscillation
16 Av=L2/L1

```

```
17 printf("gain required for sustained oscillation=\t>
    %f\n",Av)
```

Scilab code Exa 5.5.51 calculate the value of L1 and L2 of Hartley oscillator

```
1 clc
2 disp("Example 5.51")
3 printf("\n")
4 disp("calculate the value of L1 & L2 of Hartley
    oscillator")
5 printf("Given\n")
6 //frequency of oscillation
7 f=25*10^3
8 C=0.02*10^-6
9 //feedback factor
10 B=0.2
11 //Total inductance
12 L=1/(4*(%pi)^2*f^2*C)
13 L1byL2=B
14 L1plusL2=L
15 //therefore
16 L2=L/1.2
17 L1=L-L2
18 printf("The values of L1=\t%f henry\nL2=\t%f henry\n
    ",L1,L2)
```

Scilab code Exa 5.5.53 Design the value of L1 L2 and C for a hartley oscillator

```
1 clc
2 disp("Example 5.53")
3 printf("\n")
```

```

4 disp("Design the value of L1,L2 & C for a hartley
      oscillator")
5 printf(" Given\n")
6 //frequency of oscillation
7 f=30*10^3
8 //then value of LC
9 LC=1/(4*(%pi)^2*f^2)
10 //select c as
11 C=0.1*10^-6
12 //Total inductance
13 L=LC/C
14 //let L1=L2
15 L1=L/2
16 L2=L1
17 printf("The values of L1=\t%f henry\nL2=\t%f henry\
      nC=\t%e farad\n",L1,L2,C)

```

Scilab code Exa 5.5.55 calculate the frequency of oscillation of Colpitts oscillator

```

1 clc
2 disp(" Example 5.55")
3 printf("\n")
4 disp(" calculate the frequency of oscillation of
      Colpitts oscillator")
5 printf(" Given\n")
6 //capacitor
7 C1=400*10^-12
8 C2=C1
9 //inductance
10 L=2*10^-3
11 //Total capacitance
12 C=C1*C2/(C1+C2)
13 //frequency of oscillation
14 f=1/(2*%pi*sqrt(L*C))

```

```
15 printf(" frequency of oscillations \n%f hz\n",f)
```

Scilab code Exa 5.5.56 calculate the frequency of oscillation feedback factor and gain required for sustained oscillation

```
1 clc
2 disp(" Example 5.56")
3 printf(" \n")
4 disp(" calculate the frequency of oscillation ,
      feedback factor & gain required for sustained
      oscillation")
5 printf(" Given\n")
6 //Capacitance
7 C1=40*10-12
8 C2=10*10-12
9 //inductance
10 L=3*10-3
11 //total effective capacitance
12 C=C1*C2/(C1+C2)
13 //frequency of oscillation
14 f=1/(2*%pi*sqrt(L*C))
15 //feedback factor
16 B=C2/C1
17 //gain required for sustained oscillation
18 Av=C1/C2
19 printf(" gain required for sustained oscillation =\t>
      %f\n",Av)
```

Scilab code Exa 5.5.57 calculate the value of L of Colpitts oscillator

```
1 clc
2 disp(" Example 5.57")
3 printf(" \n")
```

```

4 disp(" calculate the value of L of Colpitts
      oscillator ")
5 printf(" Given\n")
6 //capacitor
7 C1=100*10^-12
8 C2=60*10^-12
9 //total effective capacitance
10 C=C1*C2/(C1+C2)
11 //frequency of oscillation
12 f=40*10^3
13 //inductance
14 L=1/(4*(%pi)^2*f^2*C)
15 printf(" inductance value is \n%f henry\n",L)

```

Scilab code Exa 5.5.58 calculate the value of C1 and C2 of Colpitts oscillator

```

1 clc
2 disp(" Example 5.58")
3 printf("\n")
4 disp(" calculate the value of C1 & C2 of Colpitts
      oscillator ")
5 printf(" Given\n")
6 //inductance
7 L=5*10^-3
8 //frequency of oscillation
9 f=50*10^3
10 //total effective capacitance
11 C=1/(4*(%pi)^2*f^2*L)
12 //feedback factor
13 B=0.1
14 //then C2/C1=0.1, so substituting in C=C1C2/(C1+C2)
      we get
15 C1=1.1*C/0.1
16 C2=0.1*C1

```



```
17 printf("The value of C1=\t%e farad\nC2=\t%e farad\n"
        ,C1,C2)
```

Scilab code Exa 5.5.59 calculate the value of L and C for a colpitts oscillator

```
1 clc
2 disp("Example 5.59")
3 printf("\n")
4 disp("calculate the value of L & C for a colpitts
        oscillator")
5 printf("Given\n")
6 //frequency of oscillation
7 f=40*10^3
8 LC=1/(4*(%pi)^2*f^2)
9 //select L
10 L=10*10^-3
11 //find C
12 C=1/(4*(%pi)^2*f^2*L)
13 //let C1=C2 so we get
14 C1=2*C
15 C2=C1
16 printf("The values of L=\t%f henry\nC1=\t%e farad\n
        nC2=\t%e farad\n",L,C1,C2)
```

Scilab code Exa 5.5.61 calculate the frequency of oscillation for Wein Bridge Oscillator

```
1 clc
2 disp("Example 5.61")
3 printf("\n")
4 disp("calculate the frequency of oscillation for
        Wein_Bridge Oscillator")
```

```

5 printf(" Given\n")
6 //Resistance
7 R=2*10^3
8 //capacitor
9 C=0.1*10^-6
10 //frequency of oscillation
11 f=1/(2*%pi*R*C)
12 printf(" frequency of oscillation \n%f hz\n",f)

```

Scilab code Exa 5.5.62 calculate the value of R and C for Wein Bridge oscillator

```

1 clc
2 disp(" Example 5.62")
3 printf("\n")
4 disp(" calculate the value of R & c for Wein-Bridge
      oscillator")
5 printf(" Given\n")
6 //frequency of oscillation
7 f=1000
8 //find RC
9 RC=1/(2*%pi*f)
10 //select C<10^-6F
11 C=0.1*10^-6
12 //the value of R
13 R=1/(2*%pi*f*C)
14 printf(" the value of c \n%f farad\n",C)
15 printf(" the value of R \n%f ohm\n",R)

```

Scilab code Exa 5.5.65 calculate the Series and parallel resonant frequencies of Crystal

```

1 clc

```

```

2 disp("Example 5.65")
3 printf("\n")
4 disp("calculate the Series & parallel resonant
      frequencies of Crystal")
5 printf("Given\n")
6 //indutance
7 L=3
8 //Capacitor due to mechanical mounting of crystal
9 Cm=10*10^-12
10 //electrical equivalent capacitance of crystal
    compliance
11 Cs=0.05*10^-12
12 //electrical equivalent resistance of crystal
    structure internal friction
13 R=2*10^3
14 //series resonant frequency
15 fs=1/(2*pi*sqrt(L*Cs))
16 Cp=Cm*Cs/(Cm+Cs)
17 //parallel resonant frequency
18 fp=1/(2*pi*sqrt(L*Cp))
19 printf("series resonant frequency \n%f hz\n",fs)
20 printf("parallel resonant frequency \n%f hz\n",fp)

```

Chapter 6

Operational Amplifier

Scilab code Exa 6.6.15 Calculate maximum frequency at which output is faithful reproduction of input

```
1 clc
2 disp(" Example 6.15")
3 printf(" \n")
4 disp(" calculate the maximum frequency at which
      output is faithful reproduction of input")
5 printf(" given")
6 disp(" slew rate=3Mv/s")
7 sr=3*106
8 Vm=12
9 // calculate Frequency
10 fmax=(sr/(2*%pi*Vm))
11 printf(" maximum frequency=%d hz" ,fmax)
```

Scilab code Exa 6.6.19 Calculate common mode output voltage

```
1 clc
2 disp(" Example 6.19")
```

```

3 printf("\n")
4 disp("calculate common mode gain & output voltage")
5 printf("Given")
6 disp("differential gain=500")
7 disp("CMRR=80dB, Input signal is 2*sin100*%pi*t")
8 Ad=500
9 CMRR=80
10 t=1/200
11 Vc=2*sin(100*%pi*t)
12 //calculate common mode gain
13 Ac=Ad/(10^(CMRR/20))
14 //calculate common mode output voltage
15 Vcmov=Ac*Vc
16 printf("Common mode gain =%f\n",Ac)
17 printf("Common mode output voltage =%f volt\n",Vcmov
    )

```

Scilab code Exa 6.6.20 Express CMRR in dB

```

1 clc
2 disp("Example 6.20")
3 printf("\n")
4 disp("To express CMRR in dB")
5 printf("given")
6 disp("Ad=10^4,Ac=0.1")
7 Ad=10^4
8 Ac=0.1
9 //to find CMRR in dB
10 CMRR=20*log10(Ad/Ac)
11 printf("CMRR in dB=%d dB",CMRR)

```

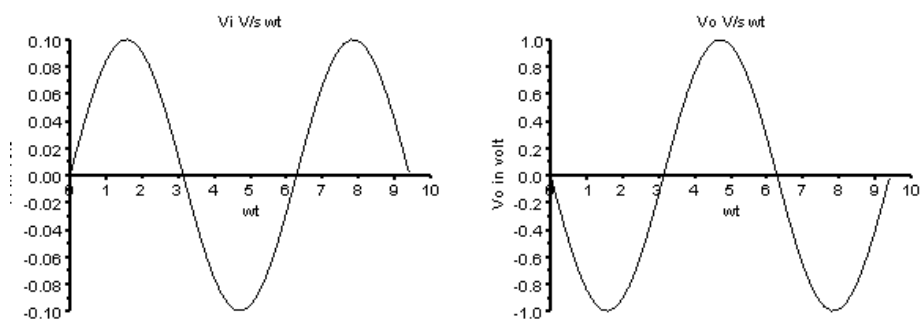


Figure 6.1: Calculate and sketch the output

Scilab code Exa 6.6.24 Calculate and sketch the output

```
1  clc
2  disp("Example 6.24")
3  printf("\n")
4  disp("calculate output voltage for inverting
        amplifier & sketch the waveform")
5  printf("given")
6  disp("Peak to peak input voltage=200mV, Rf/R1=10")
7  Vpp=200*10(-3)
8  Vm=Vpp/2
9  RfdivR1=10
10 wt=0:0.2:3*%pi
11 Vi=Vm*sin(wt)
12 Vo=-(RfdivR1)*Vi
13 disp(Vo)
14 a= gca ();
15 subplot(221)
16 a= gca();
17 a. x_location = "origin";
18 a. y_location = "origin";
19 plot2d(wt,Vi)
20 xtitle("Vi V/s wt", "wt", "Vi in volt")
21 a.thickness=2
22 subplot(222)
23 a= gca();
24 a. x_location = "origin";
25 a. y_location = "origin";
26 plot2d(wt,Vo)
27 xtitle("Vo V/s wt", "wt", "Vo in volt")
28 a.thickness=2
```

Scilab code Exa 6.6.25 Calculate design value of inverting amplifier

```
1  clc
```

```

2 disp("Example 6.25")
3 printf("\n")
4 disp("Design An Inverting Amplifier for the given
      closed loop gain")
5 printf("given")
6 disp("closed loop gain=-15")
7 Af=(-15)
8 R1=10^3
9 Rf=(-Af)*R1
10 printf("The resistance values are=\n%f ohm,\n%f ohm"
        ,R1,Rf)

```

Scilab code Exa 6.6.26 Calculate output voltage of inverting amplifier

```

1 clc
2 disp("Example 6.26")
3 printf("\n")
4 disp("calculate the output voltage for a given input
      voltages")
5 printf("given")
6 disp("input voltages=0.2,0.5 sin314t,-0.4")
7 Rf=200*10^3
8 R1=20*10^3
9 Af=(-Rf)/R1// calculate open loop gain
10 t=%pi/(2*314)//intialise t value
11 Vi=[0.2,0.5*(sin(314*t)), -0.4]
12 Vo=Af*Vi//calculate output voltage
13 printf("Output voltages are=\n%f volt,\n%f volt,\n%f
        volt",Vo)

```

Scilab code Exa 6.6.27 Calculate closed loop gain and input voltage for a specified output voltage


```

1  clc
2  disp(" Example 6.27")
3  printf("\n")
4  disp(" Calculate closed loop gain & input voltage to
      get output voltage 2v")
5  printf(" given")
6  disp(" Rf=1M,R1=20K, output voltage=2V")
7  Rf=10^6
8  R1=20*10^3
9  Vo=2
10 //calculate closed loop gain
11 Af=(-Rf/R1)
12 //calculate input voltage
13 Vi=Vo/Af
14 printf("closed loop voltage gain=%f\n",Af)
15 printf("Input voltage=%f volt",Vi)

```

Scilab code Exa 6.6.28 Calculate feedback resistor and closed loop gain

```

1  clc
2  disp(" Example 6.27")
3  printf("\n")
4  disp(" Calculate closed loop gain & input voltage to
      get output voltage 2v")
5  printf(" given")
6  disp(" Rf=1M,R1=20K, output voltage=2V")
7  Rf=10^6
8  R1=20*10^3
9  Vo=2
10 //calculate closed loop gain
11 Af=(-Rf/R1)
12 //calculate input voltage
13 Vi=Vo/Af
14 printf("closed loop voltage gain=%f\n",Af)
15 printf("Input voltage=%f",Vi)

```

Scilab code Exa 6.6.31 Calculate output voltage for given input voltage of non inverting amplifier

```
1  clc
2  disp("Example 6.31")
3  printf("\n")
4  disp("calculate output voltage for given
        specification")
5  printf("given")
6  disp("Rf=360k,R1=120k,Vi=0.5,0.6 sin314t,-0.3")
7  Rf=360*10^3
8  R1=120*10^3
9  Af=1+(Rf/R1)
10 t=0 //initialise t value
11 Vi=[0.5, 0.6*cos(314*t),-0.3]
12 Vo=Af*Vi //calculate output voltage
13 printf("output voltage =%f volt ,\n%f volt ,\n%f volt"
        ,Vo)
```

Scilab code Exa 6.6.32 Calculate closed loop gain and input voltage for a specified output voltage of noninverting amplifier

```
1  clc
2  disp("Example 6.32")
3  printf("\n")
4  disp("Calculate Gain & input voltage")
5  printf("Given")
6  disp("Rf=100K,R1=10K")
7  Rf=100*10^3
8  R1=10^4
9  //calculate voltage gain
```

```

10 Af=1+(Rf/R1)
11 Vo=4
12 //calculate input voltage
13 Vi=Vo/Af
14 //display values
15 printf("Closed loop gain =%f\n",Af)
16 printf("Input voltage=%f volt",Vi)

```

Scilab code Exa 6.6.33 Calculate output voltage for inverting amplifier

```

1 clc
2 disp("Example 6.33")
3 printf("\n")
4 disp("Calculate output voltage if input voltage is 1
      V")
5 printf("Given")
6 disp("R1=1K, Rf=100K, V+=15V, V-=-15, Vi=1v")
7 Rf=10^5
8 R1=10^3
9 //supply votage
10 Vplus=15
11 Vminus=(-15)
12 //calculate voltage gain
13 Af=(-Rf)/R1
14 Vi=1
15 // calculate output voltage
16 Vo=Af*Vi
17 //condition to check output votage is greater than
      Vplus
18 if(Vo>Vplus) then
19     printf("The Maximum positive output voltage=%f
          volt",Vplus)
20 //condition to check output voltage is less than
      Vminus
21 elseif (Vo<Vminus) then

```

```

22     printf("The maximum negative output voltage=%f
           volt",Vminus)
23 //else display Vo
24     else
25     printf("The output voltage=%f volt",Vo)
26 end

```

Scilab code Exa 6.6.34 Calculate output voltage for non inverting amplifier

```

1  clc
2  disp("Example 6.34")
3  printf("\n")
4  disp("Calculate output voltage")
5  printf("Given")
6  disp("R1=2K, Rf=200K, V+=12V, V-=-12, Vi=1.5V")
7  Rf=20^4
8  R1=2*10^3
9  Vplus=12
10 Vminus=-12
11 Af=1+(Rf/R1)
12 Vi=1.5
13 Vo=Af*Vi
14 //condition to check output voltage is greater than
   Vplus
15 if(Vo>Vplus) then
16     printf("The Maximum positive output voltage=%f
           volt",Vplus)
17 //condition to check output voltage is less than
   Vminus
18 elseif(Vo<Vminus)
19     printf("The maximum negative output voltage=%f
           volt",Vminus)
20 //else display Vo
21 else

```

```
22     printf("The output voltage=%f volt",Vo)
23 end
```

Scilab code Exa 6.6.37 Calculate closed loop gain and current

```
1  clc
2  disp("example 6.37")
3  printf("\n")
4  disp("calculate voltage gain ,input resistance ,
        current through R1")
5  printf("Given")
6  disp("Rf=100k,R1=10k")
7  disp("input voltage is 0.5v")
8  Rf=10^5
9  R1=10^4
10 Af=-Rf/R1
11 Rif=R1
12 Vi=0.5
13 I1=(Vi/R1)
14 printf("closed loop voltage gain is %3.1f\n",Af)
15 printf("input resistance is\n %3.1f ohm\n",Rif)
16 printf("current flowing through R1 is %f ampere\n",
        I1)
```

Scilab code Exa 6.6.45 Calculate output voltage for summer

```
1  clc
2  disp("Example 6.45")
3  printf("\n")
4  disp("Calculate output votage")
5  printf("Given")
6  disp("input voltage V1=-1v,V2=-2v,V3=3v")
7  disp("Resistance Rf=60k,R1=10k,R2=20k,R3=30k")
```

```

8 Rf=60*103;R1=104;R2=20*103;R3=30*103;
9 V1=-1;V2=-2;V3=3;
10 Vo=-[(Rf/R1)*V1+(Rf/R2)*V2+(Rf/R3)*V3]
11 printf("The output voltage is %f volt",Vo)

```

Scilab code Exa 6.6.55 Calculate bandwidth

```

1 clc
2 disp("Example 6.55")
3 printf("\n")
4 disp("Calculate Bandwidth with feedback")
5 printf("Given")
6 disp("Open loop voltage gain=2*105 \n")
7 disp("Break frequency is 5Hz,10% negative feedback\n")
8 A=2*105
9 B=0.1
10 Fi=5
11 //bandwidth with feedback
12 Fb=Fi*(1+A*B)
13 printf("Bandwidth with feedback is %f hz\n",Fb)

```

Scilab code Exa 6.6.56 Calculate the design value of amplifier circuit

```

1 clc
2 disp("Example 6.56")
3 printf("\n")
4 printf("Given")
5 disp("open loop gain is 100")
6 disp("Gain Bandwidth Product is 1MHz")
7 Af=100
8 GBW=106
9 ReqBandwidth=GBW/Af

```

```
10 RfbyR1=Af-1
11 printf("the ratio of resistance is=%f",RfbyR1)
```

Scilab code Exa 6.6.57 Calculate design value of circuit

```
1 clc
2 disp("Example 6.57")
3 printf("\n")
4 printf("given")
5 disp("gain is 200 & gain bandwidth product is 1MHz")
6 Af=200
7 GBW=10^6
8 BW=10^4
9 reqBW=GBW/Af
10 if(reqBW>BW) then
11     printf("Required bandwidth is=%f",reqBW)
12 else
13     Af2=10
14     Af1=200/Af2
15     R1fbyR11=Af1-1
16     R2fbyR21=Af2-1
17     printf("The ratio of resistance of both
18         amplifier circuit is=\n%d,\n%d",R1fbyR11,
19         R2fbyR21)
18 end
```

Chapter 7

Communication System

Scilab code Exa 7.7.25 Determine sideband frequencies and Bandwidth

```
1  clc
2  disp("Example 7.25")
3  printf("\n")
4  disp("calculate side band frequencies & bandwidth \n
      ")
5  printf("Given")
6  disp("Fc=600khz ,Fm=1khz")
7  Fc=6*10^5
8  Fm=10^3
9  Flsb=Fc-Fm
10 Fusb=Fc+Fm
11 BW=2*Fm
12 printf("Side band frequencies are= %d hz,\t%d hz\n",
      Flsb, Fusb)
13 printf("Bandwidth is=%d hz", BW)
```

Scilab code Exa 7.7.27 Calculate total power in modulated wave


```

1  clc
2  disp(" Example 7.27")
3  printf("\n")
4  disp(" Calculate the total power in the modulated
      wave")
5  printf(" Given")
6  disp(" carrier power=400W, modulation index=75%")
7  Pc=400
8  Ma=0.75
9  Pt=Pc*(1+(Ma^2/2))
10 printf("The total power in modulated wave =\n%f watt
      ",Pt)

```

Scilab code Exa 7.7.28 Determine radiated power

```

1  clc
2  disp(" Example 7.28")
3  printf("\n")
4  disp(" Determine the radiated power at a modulation
      index of 0.6")
5  printf(" Given")
6  disp(" carrier power=50Khz, modulation index=0.6")
7  Pc=5*10^4
8  Ma=0.6
9  Pt=Pc*(1+(Ma^2/2))
10 printf("The total power in modulated wave =\n%f watt
      ",Pt)

```

Scilab code Exa 7.7.34 Calculate carrier power

```

1  clc
2  disp(" Example 7.34")
3  printf("\n")

```

```

4 disp(" calculate carrier power")
5 printf(" Given\n")
6 disp(" total power=10KW, modulation index=0.6")
7 Pt=10^4
8 Ma=0.6
9 Pc=Pt/(1+(Ma^2/2))
10 printf("The carrier power is=%f watt\n",Pc)

```

Scilab code Exa 7.7.35 Determine power content of carrier and sidebands

```

1 clc
2 disp(" Example 7.35")
3 printf("\n")
4 disp(" Determine power content of carrier & each
      sideband")
5 printf(" Given\n")
6 disp(" Total power=2.64KW, modulation index=80%")
7 Pt=2.64*10^3
8 Ma=0.8
9 Pc=Pt/(1+(Ma^2/2))
10 Plsb=Ma^2*Pc/4
11 Pusb=Plsb
12 printf("The total power is=%f watt\n",Pc)
13 printf("The sideband power is=\n%f watt,\t%f watt",
      Plsb,Pusb)

```

Scilab code Exa 7.7.36 Calculate sideband frequencies and bandwidth and total power

```

1 clc
2 disp(" Example 7.36")
3 printf("\n")

```

```

4 disp(" Calculate sideband frequencies ,bandwidth ,power
      in sidebands ,Total power")
5 printf(" Given")
6 disp(" carrier power=1KW, carrier frequency=2MHz,
      Modulation frequency=2KHz, Modulation index=0.6")
7 Pc=10^3
8 Fc=2*10^6
9 Fm=2*10^3
10 Ma=0.6
11 Flsb=Fc-Fm
12 Fusb=Fc+Fm
13 BW=2*Fm
14 Plsb=Ma^2*Pc/4
15 Pusb=Plsb
16 Pt=Pc*(1+(Ma^2/2))
17 printf(" Sideband frequencies are=\n%d hz,\t%d hz\n",
      Flsb, Fusb)
18 printf(" Bandwidth=%d hz\n", BW)
19 printf(" Power in sidebands=\n%f watt,\t%f watt\n",
      Plsb, Pusb)
20 printf(" Total power=\n%f watt", Pt)

```

Scilab code Exa 7.7.37 Calculate modulation index

```

1 clc
2 disp(" Example 7.37")
3 printf("\n")
4 disp(" Calculate the modulation index")
5 printf(" Given\n")
6 disp(" carrier voltage=100V, Total modulated voltage
      in rms=110V")
7 Vt=110
8 Vcar=100
9 //assume R value as 1
10 R=1

```

```

11 Pt=Vt^2/R
12 Pc=Vcar^2/R
13 Ma=sqrt(2*((Pt/Pc)-1))
14 printf("Modulation index =%f",Ma)

```

Scilab code Exa 7.7.38 Determine antenna current

```

1  clc
2  disp(" Example 7.38")
3  printf("\n")
4  disp(" Determine modulation index & Antenna current
      when MODulation index changes to 0.8")
5  printf(" given\n")
6  disp(" carrier current=8A, Modulated carrier current
      =8.93A")
7  Icar=8
8  It=8.93
9  //assume R=1
10 R=1
11 Pc=Icar^2*R
12 Pt=It^2*R
13 Ma=sqrt(2*((Pt/Pc)-1))
14 //Modulated carrier current when Ma changes to 8
15 Ma1=0.8
16 It1=Icar*sqrt(1+(Ma1^2/2))
17 printf(" Modulation index =%f\n",Ma)
18 printf(" Modulated carrier current when Ma changes to
      8 is =%f ampere",It1)

```

Scilab code Exa 7.7.39 Calculate transmission power efficiency and average power in carrier component

```

1  clc

```

```

2 disp("Example 7.39")
3 printf("\n")
4 disp("Calculate transmission power efficiency and
      average power in carrier component")
5 printf("Given \n")
6 disp("Total power=20KW, Modulation index=0.7")
7 Pt=2*10^4
8 Ma=0.7
9 Pc=Pt/(1+(Ma^2/2))
10 %n=(Ma^2/(2+Ma^2))*100
11 printf("The carrier Power =%f watt\n",Pc)
12 printf("The transmission power efficiency =%f",%n)

```

Scilab code Exa 7.7.40 Calculate modulation index

```

1 clc
2 disp("Example 7.40")
3 printf("\n")
4 disp("Calculate modulation index")
5 printf("Given\n")
6 disp("maximum & minimum amplitudes are 600mv,200mv")
7 Vmax=600*10^-3
8 Vmin=200*10^-3
9 Ma=(Vmax-Vmin)/(Vmax+Vmin)
10 printf("Modulation Index is \n%f",Ma)

```

Scilab code Exa 7.7.41 Sketch the frequency spectrum

```

1 clc
2 disp("Example 7.41")
3 printf("\n")

```

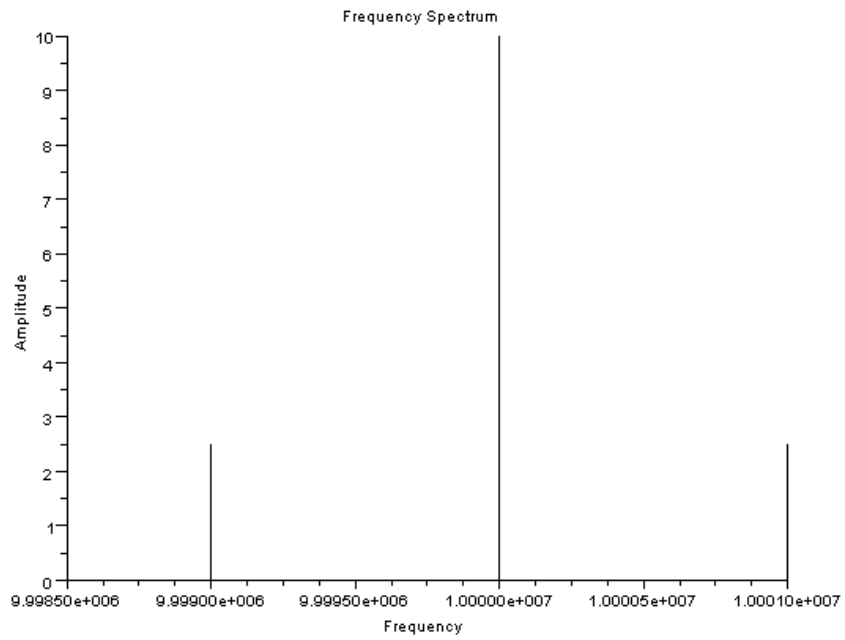


Figure 7.1: Sketch the frequency spectrum

```

4 disp("sketch the frequency spectrum")
5 printf("Given\n")
6 disp("carrier amplitude=10V, carrier frequency=10MHz,
      Modulating frequency=1Khz, MI=0.5")
7 Vc=10
8 fc=10^7
9 fm=10^3
10 ma=0.5
11 wc=2*pi*fc
12 wm=2*pi*fm
13 t=10^-7
14 v=Vc*(1+(ma*sin(wm*t)))*cos(wc*t)
15 Vs=(ma*Vc)/2
16 flsb=fc-fm
17 fusb=fc+fm
18 // take below values just for plotting graph with
      intial values
19 f1=9.9989*10^6
20 v1=0
21 f=[f1 flsb fc fusb]
22 a=[v1 Vs Vc Vs]
23 plot2d3(f,a)
24 xtitle("Frequency Spectrum")
25 xlabel("Frequency")
26 ylabel("Amplitude")

```

Scilab code Exa 7.7.42 Find the saving power in LSB alone

```

1 clc
2 disp("Example 7.42")
3 printf("\n")
4 disp("Find the saving power if power contained in
      the LSB alone is used")
5 printf("Given\n")
6 disp("Total power=20KW, Modulation Index=0.8")

```

```

7 Pt=20*10^3
8 Ma=0.8
9 Pc=Pt/(1+(Ma^2/2))
10 Plsb=(Pt-Pc)/2
11 %Ps=((Pt-Plsb)/Pt)*100
12 printf("power in sideband=%f watt\n",Plsb)
13 printf("Saving in power=\n%f\n",%Ps)

```

Scilab code Exa 7.7.55 Find maximum frequency deviation and modulation index

```

1 clc
2 disp("Example 7.55")
3 printf("\n")
4 disp("Find the maximum frequency deviation &
      modulation index")
5 printf("Given\n")
6 disp("Kf=1KHz/v, Modulating voltage=15v, frequency=3
      KHz")
7 K=10^3
8 Vm=15
9 Fm=3*10^3
10 del=K*Vm
11 Mf=del/Fm
12 printf("Maximum frequency Deviation is =\n%d hz\n",
      del)
13 printf("Modulation Index=\n%f\n",Mf)

```

Scilab code Exa 7.7.56 Calculate frequency deviation and modulation index

```

1 clc
2 disp("Example 7.56")

```



```

3 printf("\n")
4 disp("find the frequency deviation & modulation
      index")
5 printf("Given\n")
6 del=5*10^3
7 Vm=2.5
8 Kf=del/Vm
9 //when Vm=7.5
10 Vm=7.5
11 del1=Kf*Vm
12 //when Vm=10v
13 Vm=10
14 del2=Kf*Vm
15 Fm1=500
16 Mf1=del/Fm1
17 Mf2=del1/Fm1
18 Fm2=250
19 Mf3=del2/Fm2
20 printf("Frequency deviation at different modulating
      Voltage =\n%d hz\n%d hz\n",del1,del2)
21 printf("Modulation index at different frequency
      deviation & modulating frequency =\n%d\n%d\n%d\n"
      ,Mf1,Mf2,Mf3)

```

Scilab code Exa 7.7.92 Find the peak value of unknown voltage

```

1 clc
2 disp("Example 7.92")
3 printf("\n")
4 disp("Find the Peak Value")
5 printf("Given\n")
6 disp("Vpp=100v, deflection=5cm")
7 Vpp=100
8 D=5
9 DS=Vpp/D

```

```
10 //another sinusoidal produces a deflection of 8cm
11 D1=8
12 Vpp1=DS*D1
13 printf("The peak value of unknown voltage=\n%d volt\n
    n",Vpp1)
```

Chapter 8

Digital Logic

Scilab code Exa 8.8.7 Convert the binary number to decimal without decimal point

```
1  clc
2  disp("Example 8.7")
3  printf("\n")
4  disp("convert the following binary numbers to
        decimal")
5  disp("a)1011 b)110101 c)10101")
6  //Given binary number
7  bin=1011
8  i=1
9  //storing each integer digit in b(i)
10 while(bin>0)
11     b(i)=modulo(bin,10)
12     bin=floor(bin/10)
13     i=i+1;
14 end
15 //checking whether it is a binary number or not
16 for i=1:length(b)
17     if(b(i)>1) then
18         disp('not a binary number')
19         abort
```

```

20     end
21 end
22 dec=0
23 for i=1:length(b)
24 //multiplying bits of integer part with their
    position values and adding
25     dec=dec+(b(i)*2^(i-1))
26 end
27 //displaying the output
28 printf("decimal format is")
29 disp(dec)

```

Scilab code Exa 8.8.8 Convert the binary number to decimal with decimal point

```

1  clc
2  clear
3  disp("Example 8.8")
4  printf("\n")
5  disp("convert the following binary numbers to
    decimal")
6  disp("a)11.101 b)0.0111 c)110.1101")
7  //Given binary number
8  i=1;w=1
9  bin=11.101
10 //separating integer part
11 IP=floor(bin)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(bin,1)
15 //converting decimal value to interger
16 p=4
17 DP=DP*10^p //should change power of 10 as according
    to number of digits in decimal digit
18 //storing each integer digit in I(i)

```

```

19 while(IP>0)
20     I(i)=modulo(IP,10);
21     IP=floor(IP/10);
22     i=i+1;
23 end
24 //storing each decimal digit in D(w)
25 while(DP>0)
26     D(w)=modulo(DP,2)
27     DP=(DP/10)
28     DP=floor(DP)
29     w=w+1;
30 end
31 //to do zero padding of remaining erm of D(w)
32 if(length(D)<p)
33     q=length(D)
34     for f=q+1 :p
35         D(f)=0
36     end
37 end
38 if(IP1>0)
39 for i=1:length(I)//checking whether it is a binary
    number or not
40     if(I(i)>1) then
41         disp('not a binary number')
42         abort
43     end
44 end
45 end
46 if(IP1>0)
47 IP=0
48 for i=1:length(I)
49 //multiplying bits of integer part with their
    position values and adding
50     IP=IP+(I(i)*2^(i-1))
51 end
52 end
53 DP=0
54 for z=1:length(D)

```

```

55 //multiplying bits of decimal part with their
    position values and adding
56     DP=DP+(D(z)*2^(-1*(length(D)+1-z)))
57 end
58 decimal=IP+DP
59 //displaying the output
60 printf("Decimal format is")
61 disp(decimal)

```

Scilab code Exa 8.8.10 convert the decimal to binary numbers

```

1  clc
2  clear
3  disp("Example 8.10")
4  printf("\n")
5  disp("convert the following decimal to binary
    numbers")
6  disp("a) 47.8125 b) 100.0001 c) 29.3749")
7  //given decimal number
8  i=1;x=1
9  dec=47.8125
10 //separating integer part
11 IP=floor(dec)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(dec,1)
15 //storing each integer digit in I(i)
16 while(IP>0)
17     I(i)=(modulo(floor(IP),2))
18     IP=floor(IP)/2
19     i=i+1
20 end
21 if(IP1>0)
22 IP=0
23 for j=1:length(I)

```

```

24 //multiplying bits of integer part with their
    position values and adding
25     IP=IP+(I(j)*10^(j-1));
26 end
27 else
28     IP=0
29 end
30
31 //storing each decimal digit in D(x)
32 while(x<=4)
33     DP=DP*2
34     D(x)=floor(DP)
35     x=x+1
36     DP=modulo(DP,1)
37 end
38
39 DP=0
40 for j=1:length(D)
41 //multiplying bits of decimal part with their
    position values and adding
42     DP=DP+(10^(-1*j)*D(j))
43 end
44 Binary=IP+DP;
45 printf("Binary format is")
46 disp(Binary)

```

Scilab code Exa 8.8.12 convert the octal to decimal

```

1 clc
2 clear
3 disp("Example 8.12")
4 printf("\n")
5 disp("convert the following octal to decimal")
6 disp("a)243 b)124.21 c)0.65")
7 //Given octal number

```

```

8 i=1;w=1
9 oct=243
10 //separating integer part
11 IP=floor(oct)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(oct,1)
15 DP1=DP
16 //converting decimal value to interger
17 p=2
18 DP=DP*10^p //should change power of 10 as according
    to number of digits in decimal digit
19 //storing each integer digit in I(i)
20 while(IP>0)
21     I(i)=modulo(IP,10);
22     IP=floor(IP/10);
23     i=i+1;
24 end
25 //storing each decimal digit in D(w)
26 while(DP>0)
27     D(w)=modulo(DP,10)
28     DP=(DP/10)
29     DP=floor(DP)
30     w=w+1;
31 end
32 //to do zero padding of remaining erm of D(w)
33 if(DP1<1)
34     if(DP1>0)
35 if(length(D)<p)
36     q=length(D)
37     for f=q+1 :p
38         D(f)=0
39     end
40 end
41 end
42 end
43
44 if(IP1>0)

```



```

45 for i=1:length(I)//checking whether it is a octal
    number or not
46     if(I(i)>8) then
47         disp('not a octal number')
48         abort
49     end
50 end
51 end
52 if(IP1>0)
53 IP=0
54 for i=1:length(I)
55 //multiplying bits of integer part with their
    position values and adding
56     IP=IP+(I(i)*8^(i-1))
57 end
58 end
59
60 if(DP1<1)
61     if(DP1>0)
62 DP=0
63 for z=1:length(D)
64 //multiplying bits of decimal part with their
    position values and adding
65     if(D(z)<8)
66         DP=DP+(D(z)*8^(-1*(length(D)+1-z)))
67     else
68         IP=0
69         DP=0
70         printf("not a octal number")
71         abort
72     end
73 end
74 end
75
76 decimal=IP+DP
77 //displaying the output
78 printf("Decimal format")
79 disp(decimal)

```

Scilab code Exa 8.8.13 convert the decimal numbers to Octal

```
1  clc
2  clear
3  disp("Example 8.13")
4  printf("\n")
5  disp("convert the following decimal numbers to
      Octal")
6  disp("a)283 b)847.951 c)0.728")
7  //given decimal number
8  i=1;x=1
9  dec=283
10 //separating integer part
11 IP=floor(dec)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(dec,1)
15 //storing each integer digit in I(i)
16 while(IP>0)
17     I(i)=(modulo(floor(IP),8))
18     IP=floor(IP)/8
19     i=i+1
20 end
21 if(IP1>0)
22 IP=0
23 for j=1:length(I)
24 //multiplying bits of integer part with their
    position values and adding
25     IP=IP+(I(j)*10^(j-1));
26 end
27 else
28 IP=0
29 end
30
```

```

31 //storing each decimal digit in D(x)
32 if(DP<1)
33     if(DP>0)
34 while(x<=4)
35     DP=DP*8
36     D(x)=floor(DP)
37     x=x+1
38     DP=modulo(DP,1)
39 end
40
41 DP=0
42 for j=1:length(D)
43 //multiplying bits of decimal part with their
    position values and adding
44     DP=DP+(10^(-1*j)*D(j))
45 end
46 end
47 end
48 octal=IP+DP
49 printf(" Octal format")
50 disp(octal)

```

Scilab code Exa 8.8.14 convert the binary number to Octal

```

1  clc
2  clear
3  disp(" Example 8.14")
4  printf("\n")
5  disp(" convert the following binary number to Octal")
6  disp(" a)101111 b)1010101 c)1110.01101")
7  i=1;x=1;w=1
8  //convert binary to decimal
9  bin=101111
10 //separating integer part
11 IP=floor(bin)

```

```

12 IP1=IP
13 //separating decimal part
14 DP=modulo(bin,1)
15 DP1=DP
16 //converting decimal value to interger
17 p=5
18 DP=DP*10^p //should change power of 10 as according
    to number of digits in decimal digit
19 //storing each integer digit in I(i)
20 while(IP>0)
21     I(i)=modulo(IP,10);
22     IP=floor(IP/10);
23     i=i+1;
24 end
25 //storing each decimal digit in D(w)
26 while(DP>0)
27     D(w)=modulo(DP,2)
28     DP=(DP/10)
29     DP=floor(DP)
30     w=w+1;
31 end
32 //to do zero padding of remaining erm of D(w)
33 if(DP1>0)
34     if(DP1<1)
35 if(length(D)<p)
36     q=length(D)
37     for f=q+1 :p
38         D(f)=0
39     end
40 end
41 end
42 end
43 if(IP1>0)
44 for i=1:length(I)//checking whether it is a binary
    number or not
45     if(I(i)>1) then
46         disp('not a binary number')
47         abort

```

```

48     end
49 end
50 end
51 if(IP1>0)
52 IP=0
53 for i=1:length(I)
54 //multiplying bits of integer part with their
    position values and adding
55     IP=IP+(I(i)*2^(i-1))
56 end
57 end
58 if(DP1>0)
59     if(DP1<1)
60 DP=0
61 for z=1:length(D)
62 //multiplying bits of decimal part with their
    position values and adding
63     DP=DP+(D(z)*2^(-1*(length(D)+1-z)))
64 end
65 else
66 DP=0
67 end
68 else
69 DP=0
70 end
71 decimal=IP+DP
72 //displaying the output
73 disp(decimal)
74
75
76
77 //convert decimal to octal
78 i=1;
79 //separating integer part
80 IP2=floor(decimal)
81 IP3=IP2
82 //separating decimal part
83 DP2=modulo(decimal,1)

```

```

84 //storing each integer digit in I(i)
85 while(IP2>0)
86     J(i)=(modulo(floor(IP2),8))
87     IP2=floor(IP2)/8
88     i=i+1
89 end
90 if(IP3>0)
91 IP2=0
92 for j=1:length(J)
93 //multiplying bits of integer part with their
    position values and adding
94     IP2=IP2+(J(j)*10^(j-1));
95 end
96 else
97     IP2=0
98 end
99
100 //storing each decimal digit in D(x)
101 if(DP2<1)
102     if(DP2>0)
103 while(x<=4)
104     DP2=DP2*8
105     E(x)=floor(DP2)
106     x=x+1
107     DP2=modulo(DP2,1)
108 end
109
110 DP2=0
111 for j=1:length(E)
112 //multiplying bits of decimal part with their
    position values and adding
113     DP2=DP2+(10^(-1*j)*E(j))
114 end
115 end
116 end
117 octal=IP2+DP2
118 printf(" Octal format")
119 disp(octal)

```

Scilab code Exa 8.8.15 convert the octal to binary number

```
1  clc
2  clear
3  disp("Example 8.15")
4  printf("\n")
5  disp("convert the following octal to binary number")
6  disp("a)724 b)365.217 c)0.506")
7  //Given binary number
8  i=1;w=1
9  bin=724
10 //separating integer part
11 IP=floor(bin)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(bin,1)
15 DP1=DP
16 //converting decimal value to interger
17 p=2
18 DP=DP*10^p //should change power of 10 as according
    to number of digits in decimal digit
19 //storing each integer digit in I(i)
20 while(IP>0)
21     I(i)=modulo(IP,10);
22     IP=floor(IP/10);
23     i=i+1;
24 end
25 //storing each decimal digit in D(w)
26 while(DP>0)
27     D(w)=modulo(DP,10)
28     DP=(DP/10)
29     DP=floor(DP)
30     w=w+1;
31 end
```

```

32 //to do zero padding of remaining erm of D(w)
33 if(DP1<1)
34     if(DP1>0)
35 if(length(D)<p)
36     q=length(D)
37     for f=q+1 :p
38         D(f)=0
39     end
40 end
41 end
42 end
43
44 if(IP1>0)
45 for i=1:length(I)//checking whether it is a octal
    number or not
46     if(I(i)>8) then
47         disp('not a octal number')
48         abort
49     end
50 end
51 end
52 if(IP1>0)
53 IP=0
54 for i=1:length(I)
55 //multiplying bits of integer part with their
    position values and adding
56     IP=IP+(I(i)*8^(i-1))
57 end
58 end
59
60 if(DP1<1)
61     if(DP1>0)
62 DP=0
63 for z=1:length(D)
64 //multiplying bits of decimal part with their
    position values and adding
65     if(D(z)<8)
66         DP=DP+(D(z)*8^(-1*(length(D)+1-z)))

```



```

67     else
68         IP=0
69         DP=0
70         printf("not a octal number")
71         abort
72     end
73 end
74 end
75
76 decimal=IP+DP
77 //displaying the output
78 disp(decimal)
79
80
81
82 //decimal to Binary
83 //given decimal number
84 i=1;x=1
85 //separating integer part
86 IP2=floor(decimal)
87 IP3=IP2
88 //separating decimal part
89 DP2=modulo(decimal,1)
90 //storing each integer digit in I(i)
91 while(IP2>0)
92     J(i)=(modulo(floor(IP2),2))
93     IP2=floor(IP2)/2
94     i=i+1
95 end
96 if(IP3>0)
97     IP2=0
98     for j=1:length(J)
99         //multiplying bits of integer part with their
            position values and adding
100         IP2=IP2+(J(j)*10^(j-1));
101     end
102 else
103     IP2=0

```

```

104 end
105
106 //storing each decimal digit in D(x)
107 while(x<=4)
108     DP2=DP2*2
109     E(x)=floor(DP)
110     x=x+1
111     DP2=modulo(DP2,1)
112 end
113
114 DP2=0
115 for j=1:length(E)
116 //multiplying bits of decimal part with their
    position values and adding
117     DP2=DP2+(10^(-1*j)*E(j))
118 end
119 Binary=IP2+DP2;
120 printf(" Binary format")
121 disp(Binary)

```

Scilab code Exa 8.8.17 convert the hexadecimal numbers to decimal

```

1 clc
2 clear
3 disp(" Example 8.17")
4 printf("\n")
5 disp(" convert the following hexadecimal numbers to
    decimal")
6 disp(" a)FACE b)31C c)CAD")
7 //this progra, converts only integer part to decimal
8 Hdec= 'FACE'
9 dec=hex2dec(Hdec);
10 printf(" decimal=%d",dec)

```

Scilab code Exa 8.8.18 convert the decimal numbers to hexadecimal

```
1 clc
2 clear
3 disp("Example 8.17")
4 printf("\\n")
5 disp("convert the following decimal numbers to
      hexadecimal")
6 disp("a)2146 b)843 c)2604")
7 //this program, converts only integer part to
      hexadecimal
8 dec=843
9 Hdec=dec2hex(dec);
10 printf("decimal=%s" ,Hdec)
```

Scilab code Exa 8.8.19 convert the binary numbers to hexadecimal

```
1 clc
2 clear
3 disp("Example 8.19")
4 printf("\\n")
5 disp("convert the following binary numbers to
      hexadecimal")
6 disp("a)101110 b)11010 c)1011101")
7 //this program, converts only integer part to
      decimal
8 bin= '101110 '
9 dec=bin2dec(bin)
10 Hdec=dec2hex(dec)
11 printf("decimal=%s" ,Hdec)
```

Scilab code Exa 8.8.21 Add the binary numbers

```
1 kclc
2 clear
3 disp("Example 8.21")
4 printf("\n")
5 disp("Add the following binary numbers")
6 disp("a)11011 & 10110 b)1100 & 111 c)10.1011 &
   11.011")
7 //Given binary number
8 i=1;w=1
9 a=11011
10 b=10110
11 //Given binary number
12 i=1;w=1
13 bin=11.101
14 //separating integer part
15 IPa=floor(a)
16 IP1a=IPa
17 //separating decimal part
18 DPa=modulo(a,1)
19 DP1a=DPa
20 //converting decimal value to interger
21 p=4
22 DPa=DPa*10^p //should change power of 10 as
   according to number of digits in decimal digit
23
24 //storing each integer digit in I(i)
25 while(IPa>0)
26     Ia(i)=modulo(IPa,10);
27     IPa=floor(IPa/10);
28     i=i+1;
29 end
30 //storing each decimal digit in D(w)
```

```

31 while(DPa>0)
32     Da(w)=modulo(DPa,2)
33     DPa=(DPa/10)
34     DPa=floor(DPa)
35     w=w+1;
36 end
37 //to do zero padding of remaining erm of D(w)
38 if(DP1a<1)
39     if(DP1a>0)
40 if(length(Da)<p)
41     q=length(Da)
42     for f=q+1 :p
43         Da(f)=0
44     end
45 end
46 end
47 end
48
49 if(IP1a>0)
50 for i=1:length(Ia)//checking whether it is a binary
    number or not
51     if(Ia(i)>1) then
52         disp('not a binary number')
53         abort
54     end
55 end
56 end
57 if(IP1a>0)
58 IPa=0
59 for i=1:length(Ia)
60 //multiplying bits of integer part with their
    position values and adding
61     IPa=IPa+(Ia(i)*2^(i-1))
62 end
63 end
64 DPa=0
65 if(DP1a>0)
66     if(DP1a<1)

```

```

67 for z=1:length(Da)
68 //multiplying bits of decimal part with their
    position values and adding
69     DPa=DPa+(Da(z)*2^(-1*(length(Da)+1-z)))
70 end
71 end
72 end
73 decimala=IPa+DPa
74 //displaying the output
75 disp(decimala)
76
77 //for b
78 //Given binary number
79 i=1;w=1
80 //separating integer part
81 IPb=floor(b)
82 IP1b=IPb
83 //separating decimal part
84 DPb=modulo(b,1)
85 DP1b=DPb
86 //converting decimal value to interger
87 p=3
88 DPb=DPb*10^p //should change power of 10 as
    according to number of digits in decimal digit
89
90 //storing each integer digit in I(i)
91 while(IPb>0)
92     Ib(i)=modulo(IPb,10);
93     IPb=floor(IPb/10);
94     i=i+1;
95 end
96 //storing each decimal digit in D(w)
97 while(DPb>0)
98     Db(w)=modulo(DPb,2)
99     DPb=(DPb/10)
100    DPb=floor(DPb)
101    w=w+1;
102 end

```

```

103 //to do zero padding of remaining erm of D(w)
104 if(DP1b>0)
105     if(DP1b<1)
106 if(length(Db)<p)
107     q=length(Db)
108     for f=q+1 :p
109         Db(f)=0
110     end
111 end
112 end
113 end
114 if(IP1b>0)
115 for i=1:length(Ib)//checking whether it is a binary
    number or not
116     if(Ib(i)>1) then
117         disp('not a binary number')
118         abort
119     end
120 end
121 end
122 if(IP1b>0)
123 IPb=0
124 for i=1:length(Ib)
125 //multiplying bits of integer part with their
    position values and adding
126     IPb=IPb+(Ib(i)*2^(i-1))
127 end
128 end
129 DPb=0
130 if(DP1b>0)
131     if(DP1b<1)
132     for z=1:length(Db)
133 //multiplying bits of decimal part with their
        position values and adding
134     DPb=DPb+(Db(z)*2^(-1*(length(Db)+1-z)))
135     end
136 end
137 end

```

```

138 decimalb=IPb+DPb
139 //displaying the output
140 disp(decimalb)
141
142 sum1=decimala+decimalb
143 i=1;x=1
144
145 //separating integer part
146 IP=floor(sum1)
147 IP1=IP
148 //separating decimal part
149 DP=modulo(sum1,1)
150 //storing each integer digit in I(i)
151 while(IP>0)
152     I(i)=(modulo(floor(IP),2))
153     IP=floor(IP)/2
154     i=i+1
155 end
156 if(IP1>0)
157     IP=0
158     for j=1:length(I)
159         //multiplying bits of integer part with their
            position values and adding
160         IP=IP+(I(j)*10^(j-1));
161     end
162 else
163     IP=0
164 end
165
166 //storing each decimal digit in D(x)
167 while(x<=4)
168     DP=DP*2
169     D(x)=floor(DP)
170     x=x+1
171     DP=modulo(DP,1)
172 end
173
174 DP=0

```



```

175 for j=1:length(D)
176 //multiplying bits of decimal part with their
      position values and adding
177     DP=DP+(10^(-1*j)*D(j))
178 end
179 Binary=IP+DP;
180 printf("Sum")
181 disp(Binary)

```

Scilab code Exa 8.8.23 Add the octal numbers

```

1  clc
2  clear
3  disp("Example 8.23")
4  printf("\n")
5  disp("Add the following octal numbers")
6  disp("a)46 & 375 b)27.34 & 11.76")
7  //Given octal number
8  i=1;w=1
9  a=46
10 b=375
11 //separating integer part
12 IPa=floor(a)
13 IP1a=IPa
14 //separating decimal part
15 DPa=modulo(a,1)
16 DP1a=DPa
17 //converting decimal value to interger
18 p=2
19 DPa=DPa*10^p //should change power of 10 as
      according to number of digits in decimal digit
20 //storing each integer digit in I(i)
21 while(IPa>0)
22     Ia(i)=modulo(IPa,10);
23     IPa=floor(IPa/10);

```

```

24     i=i+1;
25     end
26 //storing each decimal digit in D(w)
27 while(DPa>0)
28     Da(w)=modulo(DPa,10)
29     DPa=(DPa/10)
30     DPa=floor(DPa)
31     w=w+1;
32     end
33 //to do zero padding of remaining erm of D(w)
34 if(DP1a<1)
35     if(DP1a>0)
36     if(length(Da)<p)
37         q=length(Da)
38         for f=q+1 :p
39             Da(f)=0
40         end
41     end
42 end
43 end
44
45 if(IP1a>0)
46 for i=1:length(Ia)//checking whether it is a octal
    number or not
47     if(Ia(i)>8) then
48         disp('not a octal number')
49         abort
50     end
51 end
52 end
53 if(IP1a>0)
54 IPa=0
55 for i=1:length(Ia)
56 //multiplying bits of integer part with their
    position values and adding
57     IPa=IPa+(Ia(i)*8^(i-1))
58     end
59 end

```

```

60
61 if(DP1a<1)
62     if(DP1a>0)
63 DPa=0
64 for z=1:length(Da)
65     //multiplying bits of decimal part with their
        position values and adding
66     if(Da(z)<8)
67         DPa=DPa+(Da(z)*8^(-1*(length(Da)+1-z)))
68     else
69         IPa=0
70         DPa=0
71         printf("not a octal number")
72         abort
73     end
74 end
75 end
76
77 decimala=IPa+DPa
78 //displaying the output
79 disp(decimala)
80
81 //for b
82 //Given octal number
83 i=1;w=1
84 //separating integer part
85 IPb=floor(b)
86 IP1b=IPb
87 //separating decimal part
88 DPb=modulo(b,1)
89 DP1b=DPb
90 //converting decimal value to interger
91 p=2
92 DPb=DPb*10^p //should change power of 10 as
        according to number of digits in decimal digit
93 //storing each integer digit in I(i)
94 while(IPb>0)
95     Ib(i)=modulo(IPb,10);

```

```

96     IPb=floor(IPb/10);
97     i=i+1;
98     end
99 //storing each decimal digit in D(w)
100 while(DPb>0)
101     Db(w)=modulo(DPb,10)
102     DPb=(DPb/10)
103     DPb=floor(DPb)
104     w=w+1;
105     end
106 //to do zero padding of remaining erm of D(w)
107 if(DP1b<1)
108     if(DP1b>0)
109 if(length(Db)<p)
110     q=length(Db)
111     for f=q+1 :p
112         Db(f)=0
113     end
114 end
115 end
116 end
117
118 if(IP1b>0)
119 for i=1:length(Ib)//checking whether it is a octal
        number or not
120     if(Ib(i)>8) then
121         disp('not a octal number')
122         abort
123     end
124 end
125 end
126 if(IP1b>0)
127 IPb=0
128 for i=1:length(Ib)
129 //multiplying bits of integer part with their
        position values and adding
130     IPb=IPb+(Ib(i)*8^(i-1))
131     end

```

```

132 end
133
134 if(DP1b<1)
135     if(DP1b>0)
136 DPb=0
137 for z=1:length(Db)
138     //multiplying bits of decimal part with their
        position values and adding
139     if(Db(z)<8)
140         DPb=DPb+(Db(z)*8^(-1*(length(Db)+1-z)))
141     else
142         IPb=0
143         DPb=0
144         printf("not a octal number")
145         abort
146     end
147 end
148 end
149
150 decimalb=IPb+DPb
151 //displaying the output
152 disp(decimalb)
153
154 sum1=decimala+decimalb
155 i=1;x=1
156 //separating integer part
157 IP=floor(sum1)
158 IP1=IP
159 //separating decimal part
160 DP=modulo(sum1,1)
161 //storing each integer digit in I(i)
162 while(IP>0)
163     I(i)=(modulo(floor(IP),8))
164     IP=floor(IP)/8
165     i=i+1
166 end
167 if(IP1>0)
168 IP=0

```

```

169 for j=1:length(I)
170 //multiplying bits of integer part with their
    position values and adding
171     IP=IP+(I(j)*10^(j-1));
172 end
173 else
174     IP=0
175 end
176
177 //storing each decimal digit in D(x)
178 if(DP<1)
179     if(DP>0)
180 while(x<=4)
181     DP=DP*8
182     D(x)=floor(DP)
183     x=x+1
184     DP=modulo(DP,1)
185 end
186
187 DP=0
188 for j=1:length(D)
189 //multiplying bits of decimal part with their
    position values and adding
190     DP=DP+(10^(-1*j)*D(j))
191 end
192 end
193 end
194 octal=IP+DP
195 printf("Sum")
196 disp(octal)

```

Scilab code Exa 8.8.25 Add the hexadecimal numbers

```

1 clc
2 clear

```

```

3 disp("Example 8.25")
4 printf("\n")
5 disp("Add the following hexadecimal numbers")
6 disp("a)ABC & ABCDE b) DEF & 12EF")
7 //this program add only integer part
8 a='ABC'
9 b='ABCDE'
10 a1=hex2dec(a)
11 a2=hex2dec(b)
12 sum1=a1+a2
13 sumhex=dec2hex(sum1)
14 printf("%s",sumhex)

```

Scilab code Exa 8.8.30a perform the decimal subtraction using 9s complements

```

1 clc
2 clear
3 disp("Example 8.30 a")
4 printf("\n")
5 disp("perform the following decimal subtraction
        using 9s complements")
6 disp("a)49-24      b)321-578")
7 //given numbers
8 a=49
9 b=-24
10 //should set to 99 if input is 2 digit number,999 if
    3digit number
11 c=99
12 //add c with 2nd operand
13 e=c+b
14 N=a+e
15 if(N>100)
16     if(N<199)
17         M=N-100

```

```

18     M=M+1
19     N=M
20 end
21 end
22 if(N>1000)
23     if(N<1999)
24         M=N-1000
25         M=M+1
26         N=M
27 end
28 end
29     M=N
30 if(-b>a)
31     M=-(999-M)
32 end
33 printf(" result=%d" ,M)

```

Scilab code Exa 8.8.30b perform the decimal subtraction using 10s complements

```

1  clc
2  clear
3  disp(" Example 8.30b")
4  printf("\n")
5  disp(" perform the following decimal subtraction
        using 10s complements")
6  disp(" a)49-24      b)321-578")
7  //given numbers
8  a=49
9  b=-24
10 //should set to 100 if input is 2 digit number,1000
    if 3digit number
11 c=1000
12 //add c with 2nd operand
13 e=c+b

```



```

14 N=a+e
15 if(N>100)
16     if(N<199)
17         M=N-100
18         N=M
19     end
20 end
21 if(N>1000)
22     if(N<1999)
23         M=N-1000
24         N=M
25     end
26 end
27     M=N
28 if(-b>a)
29     M=-(999-M+1)
30 end
31 printf(" result=%d" ,M)

```

Scilab code Exa 8.8.31a perform the binary subtraction using 1s complement

```

1  clc
2  clear
3  disp(" Example 8.31 a")
4  printf("\n")
5  disp(" perform the following binary subtraction
        using 1s complement")
6  disp(" a) 1010-0111 b) 0110-1101")
7  a=[1 0 1 0]
8  b=~[0 1 1 1]
9  d=0
10 for i=1:length(a)
11     c(i)=a(length(a)+1-i)+b(length(a)+1-i)+d
12     if(c(i)==1)

```

```

13         d=0
14     end
15     if [c(i)==2]
16         d=1
17         c(i)=0
18     end
19 end
20 f=1
21 if(d==1)
22     for i=1:length(a)
23         g(i)=c(i)+f
24         if(g(i)==1)
25             f=0
26         end
27         if(g(i)==2)
28             f=1
29             g(i)=0
30         end
31     end
32 end
33 for i=1:length(a)
34     c(i)=g(i)
35 end
36 end
37 if(d==0)
38     for i=1:length(a)
39         c(i)=~c(i)
40     end
41 end
42 printf("result =%d%d%d%d",c(4),c(3),c(2),c(1))

```

Scilab code Exa 8.8.31b perform the binary subtraction using 2s complement

```
1 clc
```

```

2 clear
3 disp("Example 8.31b")
4 printf("\n")
5 disp("perform the following binary subtraction
    using 2s complement")
6 disp("a)1010-0111 b)0110-1101")
7 a=[1 0 1 0]
8 b=~[0 1 1 1]
9 d=0
10 h=1
11 for i=1:length(b)
12     n(i)=b(length(b)+1-i)+h
13     if(n(i)==1)
14         h=0
15     end
16     if(n(i)==2)
17         h=1
18         n(i)=0
19     end
20
21 end
22 for i=1:length(a)
23     b(i)=n(i)
24 end
25
26
27 for i=1:length(a)
28     c(i)=a(length(a)+1-i)+b(length(a)+1-i)+d
29     if(c(i)==1)
30         d=0
31     end
32     if[c(i)==2]
33         d=1
34         c(i)=0
35     end
36 end
37
38

```

```

39 if(d==0)
40     for i=1:length(a)
41         c(i)=~c(i)
42     end
43     j=1
44     for i=1:length(b)
45         m(i)=c(i)+j
46         if(m(i)==1)
47             f=0
48         end
49         if(m(i)==2)
50             j=1
51             m(i)=0
52         end
53     end
54     for i=1:length(a)
55         c(i)=m(i)
56     end
57 end
58 for i=1:length(a)
59     C(i)=c(i)
60 end
61 printf("result =%d%d%d%d",c(4),c(3),c(2),c(1))

```

Scilab code Exa 8.8.48a Prove the boolean theorem

```

1 clc
2 clear
3 disp("Example 8.48 a")
4 printf("\n")
5 disp("Prove the following boolean theorem")
6 disp("A+AB=A")
7 disp("A=a , B=b , AB=s , A+AB=d")
8 a=[0 0 1 1]

```

```

9 b=[0 1 0 1]
10 for i=1:length(a)
11     s(i)=a(i)*b(i)
12 end
13 for i=1:length(a)
14     d(i)=s(i)+a(i)
15     if(d(i)==2)
16         d(i)=1
17     end
18
19 end
20
21 for i=1:length(a)
22     if(a(i)==d(i))
23         printf("")
24     else
25         printf(" not")
26         abort
27     end
28
29 end
30 printf(" yes")

```

Scilab code Exa 8.8.48b Prove the boolean theorem

```

1 clc
2 clear
3 disp(" Example 8.48b")
4 printf("\n")
5 disp(" Prove the following boolean theorem")
6 disp(" A+AB=A")
7 disp(" A=a , B=b , A1B=s , A+A1B=d")
8 a=[0 0 1 1]
9 b=[0 1 0 1]
10 for i=1:length(a)

```

```

11     s(i)=(~a(i))*b(i)
12 end
13 for i=1:length(a)
14     d(i)=s(i)+a(i)
15     if(d(i)==2)
16         d(i)=1
17     end
18
19 end
20
21 for i=1:length(a)
22     e(i)=a(i)+b(i)
23     if(e(i)==2)
24         e(i)=1
25     end
26 end
27
28 for i=1:length(a)
29     if((e(i)==d(i)))
30         printf("_")
31     else
32         printf("not")
33         abort
34     end
35
36 end
37 printf("yes")

```

Scilab code Exa 8.8.49a Prove the boolean identities

```

1 clc
2 clear
3 disp("Example 8.49 a")
4 printf("\n")
5 disp("Prove the following boolean identities")

```

```

6 disp("A+BC=(A+B)(A+C)")
7 A=[0 0 0 0 1 1 1 1]
8 B=[0 0 1 1 0 0 1 1]
9 C=[0 1 0 1 0 1 0 1]
10 for i=1:length(A)
11     Y(i)=A(i)+(B(i)*C(i))
12     if(Y(i)==2)
13         Y(i)=1
14     end
15 end
16 for i=1:length(A)
17     Z(i)=(A(i)+B(i))*(A(i)+C(i))
18     if(Z(i)==2)
19         Z(i)=1
20     end
21     if(Z(i)==3)
22         Z(i)=1
23     end
24     if(Z(i)==4)
25         Z(i)=1
26     end
27 end
28 for i=1:length(A)
29     if(Z(i)==Y(i))
30         printf("_")
31     else
32         printf("NOT")
33         abort
34     end
35 end
36
37 printf(" proved")

```

Scilab code Exa 8.8.49b Prove the boolean identities

```

1  clc
2  clear
3  disp("Example 8.49b")
4  printf("\n")
5  disp("Prove the following boolean identities")
6  disp("ABC+AB1C+ABC1=AB+AC")
7  A=[0 0 0 0 1 1 1 1]
8  B=[0 0 1 1 0 0 1 1]
9  C=[0 1 0 1 0 1 0 1]
10 for i=1:length(A)
11     Y(i)=(A(i)*B(i)*C(i))+(A(i)*(~B(i))*C(i))+(A(i)*B(
        i)*(~C(i)))
12     if(Y(i)==3)
13         Y(i)=1
14     end
15     if(Y(i)==2)
16         Y(i)=1
17     end
18 end
19 for i=1:length(A)
20     Z(i)=(A(i)*B(i))+A(i)*C(i)
21     if(Z(i)==2)
22         Z(i)=1
23     end
24 end
25 for i=1:length(A)
26     if(Z(i)==Y(i))
27         printf("_")
28     else
29         printf("NOT")
30         abort
31     end
32 end
33 printf(" proved")

```

Scilab code Exa 8.8.50a Construct the Truth Table for logic expression

```
1 clc
2 clear
3 disp("Example 8.50a")
4 printf("\n")
5 disp("Construct the Truth Table for logic expression
      ")
6 disp("AB1+C1")
7 A=[0 0 0 0 1 1 1 1]
8 B=[0 0 1 1 0 0 1 1]
9 C=[0 1 0 1 0 1 0 1]
10 for i=1:length(A)
11     f(i)=(A(i)*(~(B(i))))+(~C(i))
12     if(f(i)==2)
13         f(i)=1
14     end
15 end
16 printf("truth table =%d%d%d%d%d%d%d%d",f(1),f(2),f
      (3),f(4),f(5),f(6),f(7),f(8))
```

Scilab code Exa 8.8.50b Construct the Truth Table for logic expression

```
1 clc
2 clear
3 disp("Example 8.50b")
4 printf("\n")
5 disp("Construct the Truth Table for logic expression
      ")
6 disp("AB1+A1B")
7 A=[0 0 1 1]
8 B=[0 1 0 1]
9 for i=1:length(A)
10     f(i)=(A(i)*(~(B(i))))+(B(i)*(~(A(i))))
11     if(f(i)==2)
```

```

12     f(i)=1
13     end
14 end
15 printf("truth table =%d%d%d%d",f(1),f(2),f(3),f(4))

```

Scilab code Exa 8.8.50c Construct the Truth Table for logic expression

```

1  clc
2  clear
3  disp("Example 8.50 c")
4  printf("\n")
5  disp("Construct the Truth Table for logic expression
        ")
6  disp("C1((B+D)1)")
7  B=[0 0 0 0 1 1 1 1]
8  C=[0 0 1 1 0 0 1 1]
9  D=[0 1 0 1 0 1 0 1]
10 for i=1:length(B)
11     f(i)=(~(C(i)))*(~(B(i)+D(i)))
12     if (f(i)==2)
13         f(i)=1
14     end
15 end
16 printf("truth table =%d%d%d%d%d%d%d%d",f(1),f(2),f(3),f(4),f(5),f(6),f(7),f(8))

```
