

Scilab Manual for  
Electronics Devices and Circuit I  
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# Experiment: 1

## Determine Diode current for input DC voltage and temperature

Scilab code Solution 1.0 Determine Diode current for input DC voltage and temperature

```
1 //EX 1. Program Title:Determine Diode current for
   input DC voltage and temperature.///
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
5 //////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 mprintf('\\n Required Data for  $I_D=I_s*(e^{(V_D/n*V_T)}-1)$ 
   is: ');
10 mprintf('\\n');
11 VD=input('Enter the value of input DC Voltage in
   volts: ');//Note:Input DC voltage is int range of
   0 to 5
```

```

12 T=input('Enter the value of temperature in degree
    Celsius : ');//Note: temperature is in the degree
    celsius
13 p=273;
14 TK=p+T;
15 k=1.38e-23 //Joule per Kelvin Boltzmann's
    Constant
16 k1=k*1e21 //zepto Joule per kelvin
17 q= 1.6e-19 // columb electron
    charge
18 q1=q*1e18 // atto coulomb electron
    charge
19 Is=10e-12 // Amperes Reverse
    saturation current
20 Is1=Is*1e9//nano amperes
21 n=1 ; // Ideality factor
22 mprintf('\n.
    \*****\
    ');
23 mprintf('\n Temperature TK:%2d
    K',TK);
24 mprintf('\n Ideality factor n:%2d '
    ,n);
25 mprintf('\n Reverse saturation Current Is:%.3 f
    nA',Is1);
26 mprintf('\n Boltzmanns Constant.. k:%.5 f
    zJ/K',k1);
27 mprintf('\n Electron charge.. q:%.2 f
    aC',q1);
28 mprintf('\n Forward bias voltage VD:%.2 f
    V',VD);
29 mprintf('\n.
    \*****\
    ');
30 //////////////////////////////////////
31 mprintf('\n Diode Current ID=Is (e^x-1)'
    );
32 mprintf('\n Where.. x=VD/(n*VT) ')

```

```

;
33 mprintf( '\n Thermal Voltage          VT=(k*TK)/q ')
;
34 mprintf( '\n. \***** Solution
*****\ ');
35 [ID1,x,VT]=diode_current2(VD,TK)//Function of diode
current
36 mprintf( '\n Thermal Voltage.....VT = %f V \n
',VT); // Theramal Voltage Display
37 mprintf( '\n'); // Next line
38 mprintf( ' ..... x=%f \n',x);
39 mprintf( '\n'); // Next line
40 mprintf( 'Diode Current..... ID= %f mA \n',
ID1); //Diode Current Display
41 mprintf( '\n.
\*****\
');
42
43
44 //Output
45
46 // Required Data for ID=Is*(e^(VD/n*VT)-1) is:
47 //Enter the value of input DC Voltage in volts: .45
48 //Enter the value of temperature in degree Celsius :
27
49
50 //.
*****

51 // Temperature          TK:300 K
52 //Ideality factor      n: 1
53 //Reverse saturation Current   Is:0.010 nA
54 //Boltzmanns Constant.. k:0.01380 zJ/K
55 //Electron charge.. q:0.16 aC
56 // Forward bias voltage   VD:0.45 V
57 //.
*****

```

```

58 // Diode Current          ID=Is (e^x-1)
59 // Where..                x=VD/(n*VT)
60 // Thermal Voltage       VT=(k*TK)/q
61 // . *****Solution
        *****
62 // Thermal Voltage .....VT = 0.025875 V
63
64 // ..... x=17.391304
65
66 //Diode Current ..... ID= 0.000357 mA
67
68 // .
        *****

```

---

check Appendix [AP 1](#) for dependency:

diode\_current2.sci

## Experiment: 2

# To Plot the V-I Characteristics of semiconductor diode under forward Bias using Shockley equation

**Scilab code Solution 2.0** To Plot the VI Characteristics of semiconductor diode under forward Bias using Shockley equation

```
1 //EX 2. Program Title:To Plot the V-I
   Characteristics of semiconductor diode under
2 //forward Bias using Shockley equation//
3 //
   //////////////////////////////////////
4 ///Environment: Scilab 5.5.2
5 //Tested on OS: Windows 7 Professional , 64 bit
6 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
7 //
   //////////////////////////////////////
8 clc;
```

```

9 clear all;
10 close;
11 xdel(winsid());///clear all the previous figures
    plots
12 //////////////////////////////////////Forward Bias
    Characterisices////////////////////////////////////
13 VD_fw=input("Enter the Maximum Forward Voltage for
    input:")//note:it is positive value DC voltage
    press enter after givening input votage in
    console
14 VD=[0:0.01:VD_fw];          // Change in
    input volatage
15 ID=10e-12*(exp(VD/0.039)-1); // Diode current
    equation
16 ID=ID*1e3;                  // Diode Current in
    miliampere
17 figure(1),plot(VD,ID,'*');// plotting VD and ID
18 xtitle("Diode Forward Bias characteristics", "Diode
    Voltage VD (V)", "Diode Current ID (mA)");//plot
19 //////////////////////////////////////Reversed Biased
    Characteristics////////////////////////////////////
20 VD_rev=input("Enter the Maximum Reverse Voltage for
    input:")//note:it is negative value DC voltage
    press enter after givening input votage in
    console
21 VDr=[0:-0.01:-VD_rev];     // Change in
    input volatage
22 IDr=-10e-12*(exp(VD/0.039)-1); // Diode current
    equation
23 IDr=IDr*1e3;                // Diode Current in
    miliampere
24 figure(2),plot(VDr,IDr,'*');// plotting -VD and -ID
25 xtitle(" Diode Reversed Bias characteristics", "Diode
    Voltage -VD (V)", "Diode Current -ID (mA)");//
    plot
26
27
28 //output

```

29

30

31 //Enter the Maximum Forward Voltage for input:5

32 //Enter the Maximum Reverse Voltage for input:5

---

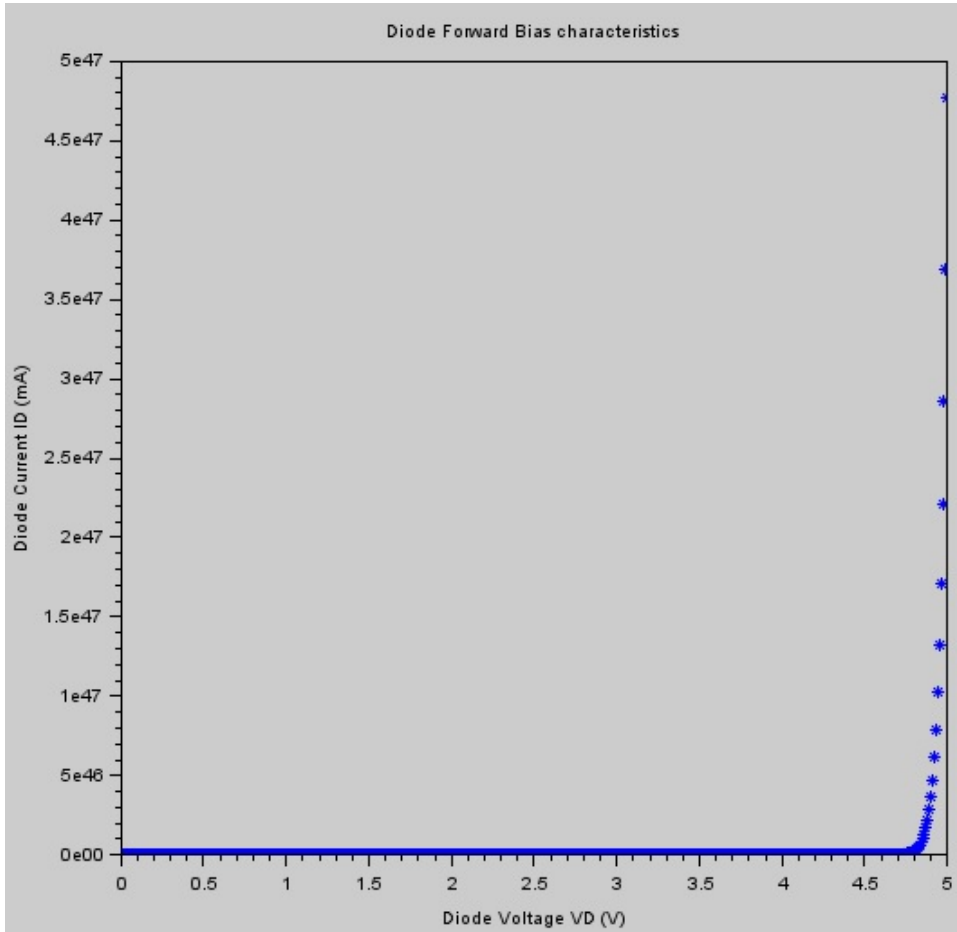


Figure 2.1: To Plot the VI Characteristics of semiconductor diode under forward Bias using Shockley equation

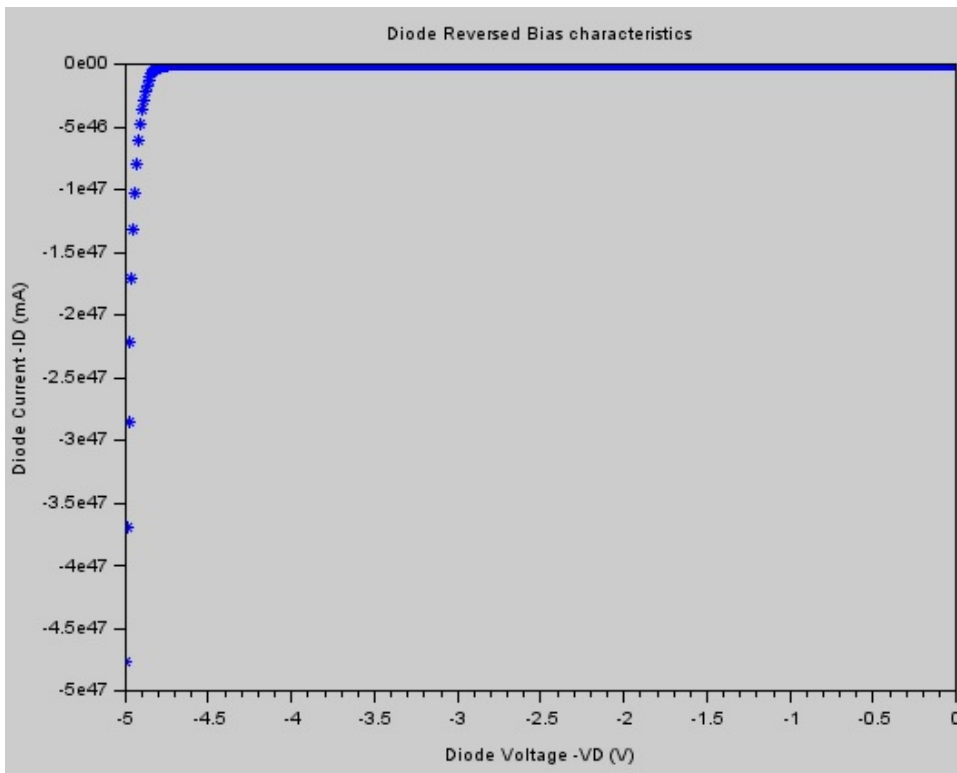


Figure 2.2: To Plot the VI Characteristics of semiconductor diode under forward Bias using Shockley equation

## Experiment: 3

# Determine static and dynamic resistance for PN junction diode using V-I characteristics

**Scilab code Solution 3.0** Determine static and dynamic resistance for PN junction diode using VI characteristics

```
1 //EX 3 Program Title:Determine static and dynamic
  resistance for PN junction diode using VI
  characteristics //////////////////////////////////
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
  Robert Boylestead and Nashelsky
5 ////////////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
  ////////////////////////////////////////////
10 disp('*****DC resistances of diode can be
  calculated by using operating points on the
```

```

        forward characteristic*****');
11 ID1=input("Enter the value of ID on the curve in mA
    ID:");//Note:Press enter
12
13 VD=input("Enter the Corresponding value of VD on the
    curve in V VD:");//Note:Press enter //VD is in
    the range of 0V to 1V
14 ID=ID1*1e-3    /// miliampere Diode cuurent1
15 mprintf('\n
    \*****\
    ');
16 mprintf('\n For the operating points');
17 mprintf('\n Diode current      ID1:%.4f A',ID);
18 mprintf('\n Diode Voltage      VD1:%.1f V',VD);
19 RD=VD/ID;    /// Ohms DC resistance
20 mprintf('\n
    \*****\
    ');
21 mprintf('\n DC resistance is RD1:%.1f ohms',RD);
22 mprintf('\n
    \*****\
    ');
23 //disp('*****AC resistances of diode can be
    calculated by Dawing straight line through
    operating points (VD,ID) and change in volages(
    VD1 and VD2) and corresponding change in currents
    (ID1 and ID2)is to be considered on the curve
    *****');//
24 ///Tangent line at ID is drawn and 2mA swing above
    and below is to be considered for ID2 and ID1
    respectively/////////
25 ID11=ID1-2    //in mili amperes
26 ID12=ID1+2    //in mili amperes
27 ////////////conversion//////////
28 ID11=ID11*1e-3;
29 ID12=ID12*1e-3;
30 mprintf('\n
    \*****\

```

```

    ');
31 mprintf('\n For calculation of AC resistance at the
    operating points ID');
32 mprintf('\n Diode current1          ID11:%.4 f A',ID11)
    ;
33 mprintf('\n Diode current2          ID12:%.4 f A',ID12)
    ;
34 if ID1<4 then //when the characteristics curve ID
    current (below 4mA)exponential ch
        anges in curve more even VD
        //changes
35 VD11=VD-0.05; //Swing of tangent line in
    downword direction and locating point
36 //respective voltage is VD11 //
    small change in voltage
37 VD12=VD+0.05; //Swing of tangent line in upword
    direction and locating point
38 //respective voltage is VD12 //
    small change in voltage
39 else
40 VD11=VD-0.01; //neligibal chane in voltage
    because steep curve when
41 VD12=VD+0.01;
42 end
43 mprintf('\n Diode Voltage1          VD11:%.2 f V',VD11
    );
44 mprintf('\n Diode Voltage2          VD12:%.2 f V',VD12
    );
45 mprintf('\n
    \*****\
    ');
46 //calaculation
47 delid1=ID12-ID11; //difference in
    upper current and lower current
48 delvd1=VD12-VD11; //difference in
    upper current and lower voltage
49 rd1=delvd1/delid1; // ac resisstance
    at ID=2mA

```

```

50 mprintf( '\n AC resistance at      ID1 is rd1:%.4f ohm'
    ,rd1);
51 mprintf( '\n.
    \*****\
    ');
52 //output/////////case1
53 //*****DC resistances of diode can be calculated by
    using
54 //      operating points on the forward
    characteristic*****
55 //      **
56 //Enter the value of ID on the curve in mA ID:2
57 //Enter the Corresponding value of VD on the curve
    in V VD:.5
58
59 //
    *****

60 // For the operating points
61 // Diode current      ID1:0.0020 A
62 // Diode Voltage      VD1:0.5 V
63 //
    *****

64 //DC resistance is RD1:250.0 ohms
65 //
    *****

66 //
    *****

67 // For calculation of AC resistance at the operating
    points ID
68 // Diode current1      ID11:0.0000 A
69 // Diode current2      ID12:0.0040 A
70 // Diode Voltage1      VD11:0.45 V
71 // Diode Voltage2      VD12:0.55 V
72 //

```

```

*****
73 //AC resistance at ID1 is rd1:25.0000 ohm
74 //.
*****

75
76 ///case2//////////
77 //*****DC resistances of diode can be calculated
    by using
78 //      operating points on the forward
    characteristic*****
79 //      **
80 //Enter the value of ID on the curve in mA ID:25
81 //Enter the Corresponding value of VD on the curve
    in V VD:.7
82
83 //
*****

84 // For the operating points
85 // Diode current ID1:0.0250 A
86 // Diode Voltage VD1:0.7 V
87 //
*****

88 // DC resistance is RD1:28.0 ohms
89 //
*****

90 //
*****

91 // For calculation of AC resistance at the operating
    points ID
92 //Diode current1 ID11:0.0230 A
93 //Diode current2 ID12:0.0270 A
94 // Diode Voltage1 VD11:0.69 V

```

```
95 // Diode Voltage2          VD12:0.71 V
96 //
    *****
97 // AC resistance at      ID1 is rd1:5.0000 ohm
98 //
    *****
```

---

## Experiment: 4

# Design zener shunt regulator with variable load for given specification

Scilab code Solution 4.0 Design zener shunt regulator with variable load for given specification

```
1 //EX.4 Program Title:Design zener shunt regulator
   with variable load for given specification///
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
5 ///////////////////////////////////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
   ///////////////////////////////////////////////////////////////////

10 disp('For designing Variable Load voltage regulator
   Circuit :' );
11 Vi=input('Enter the Input Voltage in volts
```

```

Vi: ');//Note:Press enter
    /// input voltage must be greater than dc
    regulated voltage/////
12 Vz=input('Enter the required regulated DC output
    Voltage in volts Vz: ');//Note:Press enter
13 Izm=input('Enter the value of Maxi. zener current in
    miliamperes Izm: ');//Note:Press enter/
14 R=input('Enter the value of Series Resistance in
    kilo ohms R: ');//Note:Press enter/
15 disp('According to given Circuit data: ');
16 Izm1=Izm*1e-3 //miliampere Maximum Zener
    Current
17 R1=R*1e3 // Kilo ohms Input Resistance
18 mprintf('\n Zener Voltage Vz:
    %1fv ',Vz);
19 mprintf('\n Maximum Zener Current Izm
    :%2fA ',Izm1);
20 mprintf('\n Input Resistance R:
    %4dohms ',R1);
21 mprintf('\n Input voltage Vi:
    %2dV ',Vi);
22 mprintf('\n ');
23 ///////////////Calculate Value of Minimum RL
    ///////////////
24 mprintf('\n. \*****Solution
    *****\ ');
25 RL_min=(R1*Vz)/(Vi-Vz); //ohms min load resistance
26 mprintf('\n 1)Minimum Load Resistance
    RL_min:%2dohms ',RL_min);
27 ///////////////Calculate Value of Minimum Load
    Current////////////////////////////////////
28 mprintf('\n.
    \*****\ ');
29 VR=Vi-Vz; // volts voltage across input
    resistance
30 mprintf('\n 2)Voltage Across R is
    VR=%2dV ',VR);

```

```

31 IR=VR/R1; // mili amperes Current through input
    resistance
32 IR=IR*1e3; //amperes
33 mprintf('\n.
    \*****\
    ');
34 mprintf('\n 3)Current through Input Resistance R is
    IR:%.4mA ', IR);
35 IL_min=(IR*1e-3)-Izm1; // mili amperes mini. load
    current
36 //IL_min=IL_min*10e3;
37 mprintf('\n.
    \*****\
    ');
38 mprintf('\n 4)Minimum Load Current
    IL_min=%.3mA ', IL_min);
39 mprintf('\n.
    \*****\
    ');
40 //Calculate Value of Maximum Load
    Resistance////////////////////////////////////
41 RL_max=Vz/(IL_min); // ohms maxi. load resistance
42 //RL_max=RL_min*1e-3;
43 mprintf('\n 5)Maximum Load Resistance
    RL_max: %dohms ', RL_max);
44 mprintf('\n.
    \*****\
    ');
45
46
47 //output//
48 // For desiging Variable Load voltage regulator
    Circuit :
49 //Enter the Input Voltage in volts
    Vi:50
50 //Enter the required regulated DC output Voltage in
    volts Vz:10
51 //Enter the value of Maxi. zener current in

```

```

        miliamperes      Izm:32
52 //Enter the value of Series Resistance in kilo ohms
        R:1
53
54 // According to given Circuit data:
55
56 // Zener Voltage                Vz:10.000000
        v
57 // Maximum Zener Current        Izm:0.032000
        A
58 // Input Resistance              R:1000ohms
59 // Input voltage                 Vi:50V
60
61 // . *****Solution
        *****
62 // 1)Minimum Load Resistance
        RL_min:250ohms
63 // .
        *****
64 // 2)Voltage Across R is                VR=40
        V
65 // .
        *****
66 //3)Current through Input Reistance R is      IR
        :40.0000mA
67 // .
        *****
68 // 4)Minimum Load Current
        IL_min=0.008A
69 // .
        *****
70 // 5)Maximum Load Resistance
        RL_max:1250ohms
71 // .

```

\*\*\*\*\*



## Experiment: 5

# Design zener shunt regulator with fixed load for given specification

Scilab code Solution 5.0 Design zener shunt regulator with fixed load for given specification

```
1 //EX 5 Program:Design zener shunt regulator with
   fixed load for given specification ///
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
5 //////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
   //////////////////////////////////////

10 disp('For designing fixed Load voltage regulator
   Circuit :' );
11 Vz=input("Enter the required regulated DC output
```

```

Voltage in volts Vz:");//Note:Press enter
12 Izm=input('Enter the value of maxi. zener current in
miliamperes Izm:');//Note:Press enter/
13 RL=input('Enter the value of load resistance in kilo
ohms RL:');//Note:Press enter/
14 R=input('Enter the value of Series resistance in
ohms R:');//Note:Press enter/
15 disp('For desiging fixed voltage regulator Circuit
required data :');
16 Izm1=Izm*1e-3 //miliamper Maximum Zener
Current
17 RL1=RL*1e3 // Kilo ohms Input Resistance
18 mprintf('\n Zener Voltage Vz:%1f
v',Vz);
19 mprintf('\n Maximum Zener Current Izm:
%2f A',Izm1);
20 mprintf('\n Input Resistance R:%4d
ohms',R);
21 mprintf('\n Load Resistance RL:%.1
f Ohms',RL1);
22 mprintf('\n');
23 ///////////////Calculate Minimum input Voltage
////////////////////
24 mprintf('\n. \*****Solution
*****\');
25 Vi_min=((RL1+R)*Vz)/RL1;// Volts Min. input Voltage
26 mprintf('\n 1)Minimum Input Voltage
Vi_min:%2dV',Vi_min);
27 ///////////////Calculate Value of Minimum Load
Current////////////////////
28 mprintf('\n.
\*****\');
29 IL=Vz/RL1; // mili amperes Load Cuent
30 IL_ma=IL*1e3 // mil amperes
31 mprintf('\n 2)Load Current is
IL=%2fmA',IL_ma);
32 IR_max=Izm1+IL; // mili amperes maxi. Load Cuent

```

```

33 IR_maxD=IR_max*1e3; // miliamper
34 mprintf( '\n.
    \*****
    ');
35 mprintf( '\n 3) Current through input Resistance R is
    IR_max:%.4fmA ', IR_maxD);
36 Vi_max=(IR_max*R)+Vz; //Volts Maxi.input voltage
37 mprintf( '\n.
    \*****\ ');
38 mprintf( '\n 4) Maximum input voltage
    Vi_max=%2dV ', Vi_max);
39 mprintf( '\n.
    \*****
    ');
40
41
42 //output//
43
44 //For desiging fixed voltage regulator Circuit :
45 //Enter the required regulated DC output Voltage in
    volts Vz:20
46 //Enter the value of maxi. zener current in
    miliamperes Iz:60
47 //Enter the value of load resistance in kilo ohms
    RL:1.6
48 //Enter the value of Series resistance in ohms
    R:220
49
50 //For desiging fixed voltage regulator Circuit
    required data
51 :
52
53 //Zener Voltage Vz:20.000000 v
54 //Maximum Zener Current Izm:0.060000 A
55 // Input Resistance R: 220 ohms
56 // Load Resistance RL:1600.0 Ohms
57
58 //./\ ***** Solution

```

```

*****
59 //1)Minimum Input Voltage Vi_min
   :22V
60 //.
   *****

61 // 2)Load Current is IL
   =12.50000mA
62 //.
   *****

63 // 3)Current through input Reistance R is IR_max
   :72.5000mA
64 //. *****
65 //4)Maximum input voltage Vi_max
   =35V
66 //.
   *****

```

---

## Experiment: 6

# Determine output resistance, dc and ac of Common Emitter (CE) configuration

**Scilab code Solution 6.0** Determine output resistance  $\beta_{dc}$  and  $\beta_{ac}$  of Common Emitter configuration

```
1 //EX 6 Program Title:Determine output resistance ,
   dc and ac of Common Emitter configuration.///
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
5 ///////////////////////////////////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
   ///////////////////////////////////////////////////////////////////
10 disp('*****On the output characteristics of CE
   confi. in active region select an operating point
   (VCEQ,ICQ) on load line*****');
```

```

11 ICQ1=input("Enter the value of ICQ on the curve in
    mA ICQ: "); //Note:Press enter
12 //draw horizontal line from operating point//0 mA to
    10 mA
13 IB1=input("Enter the value of IB corresponding to
    ICQ in uA IB: "); //Note:Press enter
14 VCEQ=input("Enter the Corresponding value of VCEQ :
    "); //Note:Press enter// Draw vertical
    line from operating point //VCEQ is in the
    range of 0V to 20V
15 mprintf('\n.
    \*****\
    ');
16 ICQ=ICQ1*1e-3;
17 IB=IB1*1e-6;
18 mprintf('\n Operating point Collector Current
    ICQ:%1f A',ICQ);
19 mprintf('\n Corresponding Base Current
    IB:%1f A',IB);
20 mprintf('\n Respective Collector to Emitter voltage
    is VCEQ:%1fV',VCEQ)
21 //
    //////////////////////////////////////
22 //*****Solution
    \*****\');
23 ///////////////Calculate Beta DC
    //////////////////////////////////////
24 mprintf('\n.
    \*****\
    ');
25 Beta_DC=ICQ/IB; // DC current gain
26 mprintf('\n 1)DC current gain of transistor in CE
    Confi. Beta_DC=%2d ',Beta_DC);
27 mprintf('\n. \*****Calculation of
    ac \*****\');
28 //For calculation of ac by taking change(ib1 ib2)
    in base current on either side of Q-pointalong

```

```

        the vertical axis of about equal distance to
        either side of Q-point//
29  ib1=IB1-5;
30  ib2=IB1+5;
31
32  mprintf('\n Base current1           ib1=%0.2 f uA '
        ,ib1);
33  mprintf('\n Base current2           ib2=%0.2 f uA '
        ,ib2);
34  ib1=ib1*1e-6;
35  ib2=ib2*1e-6;
36  //at the two intersections of ib1 and ib2 and
        vertical axis the two level of ic1,ic2 can be
        determine by drawing horizontal line
37  ic1=ICQ1-0.5;
38  ic2=ICQ1+0.5;
39  mprintf('\n Collector current1       ic1=%0.2
        f mA',ic1);
40  mprintf('\n Collector current2       ic2=%0.2
        f mA',ic2);
41  ic1=ic1*1e-3;
42  ic2=ic2*1e-3;
43  mprintf('\n.
        \*****\
        ');
44  Beta_AC=(ic2-ic1)/(ib2-ib1); // AC current gain
45  mprintf('\n 2)AC current gain of transistor in CE
        Confi. Beta_AC:%2d',Beta_AC);
46  ////////////////////////////////// Calculate Beta DC
        //////////////////////////////////
47  mprintf('\n. \***** Calculation of AC
        resistance*****\ ');
48  //At the operating point tangent is drawwn and
        either side of ic1 ic2 respective values of vce1
        vce2 is considered for calculation of AC
        resistance // there is small change in ic for
        more change in vce//
49  vce1=VCEQ-5.2;

```

```

50 vce2=VCEQ+5.5;
51 fprintf('\n Collector to emitter voltage1
           vce1=%2d v',vce1);
52 fprintf('\n Collector to emitter voltage2
           vce2=%2d v',vce2);
53 fprintf('\n.
           \*****\
           ');
54 R_out=(vce2-vce1)/(ic2-ic1); // AC resistance
55 R_out=R_out*1e-3; // Kilo ohms
56 fprintf('\n 3)Dynamic Output resistance is
           R_out:%1dKohm',R_out);
57 fprintf('\n.
           \*****\
           ');
58 //output/////
59 //*****On the output characteristics of CE confi.
           in active
60 //           region select an operating point(VCEQ,ICQ)
           on load l
61 //           ine*****
62 //Enter the value of ICQ on the curve in mA ICQ: 2.7
63 //Enter the value of IB corresponding to ICQ in uA
           IB: 25
64 //Enter the Corresponding value of VCEQ : 7.5
65
66 //.
           *****

67 // Operating point Collector Current           ICQ
           :0.002700 A
68 // Corresponding Base Current           IB
           :0.000025 A
69 // Respective Collector to Emitter voltage is VCEQ
           :7.500000V
70 //.
           *****

```

```

71 // 1)DC current gain of transistor in CE Confi.
    Beta_DC=108
72 //. ***** Calculation of a c
    *****
73 // Base current1          ib1=20.00 uA
74 // Base current2          ib2=30.00 uA
75 // Collector current1     ic1=2.20 mA
76 // Collector current2     ic2=3.20 mA
77 //.
    *****

78 // 2)AC current gain of transistor in CE Confi.
    Beta_AC:100
79 //. ***** Calculation of AC resistance
    *****
80 // Collector to emitter voltage1          vce1=
    2 v
81 // Collector to emitter voltage2          vce2
    =13 v
82 //.
    *****

83 // 3)Dynamic Output resistance is
    R_out:10Kohm
84 //.
    *****

```

---

## Experiment: 7

# Determine PIV, Vdc,Idc,Vrms,Pdc and Irms for Half Wave Rectifier.

Scilab code Solution 7.0 Determine PIV Vdc Idc Vrms Pdc and Irms for Half Wave Rectifier

```
1 //EX 7 Program Title:Determine PIV,Vdc,Idc ,Vrms ,Pdc
   and Irms for Half Wave Rectifier.
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
   Robert Boylestead and Nashelsky
5 //////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 xdel(winsid());///clear all the previous figures
   plots
10 //
   //////////////////////////////////////
11 disp('For Half Wave Rectifier Analysis: ');
```

```

12 RL=input('Enter the value of Load Resistance in Ohms
           RL: ');//Note:Press enter
13 Vac=input('Enter the value of Input AC Voltage in
           Volts      Vac: ');//Note:Press enter
14 N1=input('Enter the Number of primary turns in trun
           ratio      N1: ');//Note:Press enter/
15 N2=input('Enter the Number of Secondary turns in
           trun ratio N2: ');//Note:Press enter/
16 mprintf('\n.
           \*****\ ');
17 disp('Given data for Half Wave Rectifier is: ');
18 mprintf(' Load Resistance          RL: %.2f ohm',RL
           );
19 mprintf('\n Input AC voltage          V1: %2d V',Vac
           );
20 mprintf('\n Number of Secondary turns  N2: %1d ',N2);
21 mprintf('\n Number of Primary turns    N1: %1d ',N1);
22 ////////////////Voltage at Secondary
           //////////////////////////////////////
23 mprintf('\n. \***** Solution
           *****\ ');
24 V2=Vac*(N2/N1); // Volts RMS secondary voltage
25 mprintf('\n 1) Voltage at Secondary is V2: %2d',V2);
26 ////////////////Maximum Value at Secondary
           //////////////////////////////////////
27 mprintf('\n.
           \*****\ ');
28 Vm=sqrt(2)*V2; //Volt peak value of Voltage
29 mprintf('\n 2) Maximum value of secondary voltage is
           Vm: %2d ',Vm);
30 mprintf('\n.
           \*****\ ');
31 ////////////////Load Current
           //////////////////////////////////////
32 Im=Vm/RL; // Amperes peak value of current
33 mprintf('\n 3) Maxi. value of load Current is Im: %1f A
           ', Im);
34 mprintf('\n.

```

```

\*****\ ');
35 //Maximum Load Power
//
36 Pmax=(Im^2)*RL; //Watts
37 mprintf('\n 4)Maximum Load Power is Pmax:%1f W',Pmax
);
38 mprintf('\n.
\*****\ ');
39 Vdc=0.318*Vm; //Volts
40 mprintf('\n 5)Average Value of Output Voltage is Vdc
:%1f V',Vdc);
41 mprintf('\n.
\*****\ ');
42 Idc=Vdc/RL; //Amperes DC Load current
43 mprintf('\n 6)Average value of Load current is Idc:
%1f A',Idc);
44 mprintf('\n.
\*****\ ');
45 Pdc=(Idc^2)*RL; // Watts Average Power
46 mprintf('\n 7)Average Value Of load Power is Pdc:%1f
W',Pdc);
47 mprintf('\n.
\*****\ ');
48 PIV=Vm; //Volts Peak Inverse Voltage
49 mprintf('\n 8)Peak Inverse Voltage is PIV:%1d V',PIV
);
50 mprintf('\n.
\*****\ ');
51 Vr=Vdc*1.21; //Volts Ripple voltage
52 mprintf('\n 9)Ripple Voltage is Vr:%1f V',Vr);
53 mprintf('\n.
\*****\ ');
54 Irms=Im/2; //Amperes RMS Value of Current
55 mprintf('\n 10)RMS Value of current is Irms:%1f mA'
,Irms);
56 mprintf('\n.
\*****\ ');
57 //output//

```

```

58
59 //For Half Wave Rectifier Analysis:
60 //Enter the value of Load Resistance in Ohms
    RL:200
61 //Enter the value of Input AC Voltage in Volts
    Vac:230
62 //Enter the Number of primary turns in trun ratio
    N1:2
63 //Enter the Number of Secondary turns in trun ratio
    N2:1
64
65 //. *****
66 // Given data for Half Wave Rectifier is:
67 // Load Resistance          RL:200.00 ohm
68 // Input AC voltage         V1:230 V
69 // Number of Secondary turns N2:1
70 // Number of Primary turns  N1:2
71 //. *****Solution
    *****
72 //1) Voltage at Secondary is V2:115
73 //. *****
74 // 2)Maximum value of secondary voltage is Vm:162
75 //. *****
76 // 3)Maxi.value of load Current is Im:0.813173 A
77 //. *****
78 // 4)Maximum Load Power is Pmax:132.250000 W
79 //. *****
80 // 5)Average Value of Output Voltage is Vdc
    :51.717790 V
81 //. *****
82 // 6)Average value of Load current is Idc:0.258589 A
83 //. *****
84 // 7)Average Value Of load Power is Pdc:13.373649 W
85 //. *****
86 // 8)Peak Inverse Voltage is PIV:162 V
87 //. *****
88 // 9)Ripple Voltage is Vr:62.578526 V
89 //. *****

```

90 // 10)RMS Value of current is Irms:0.406586 mA  
91 // . \*\*\*\*\*

---

## Experiment: 8

# Determine PIV, Vdc,Idc,Vrms,Pdc and Irms for center tapped transformer full Wave Rectifier.

**Scilab code Solution 8.0** Determine PIV Vdc Idc Vrms Pdc and Irms for  
center tapped transformer full Wave Rectifier

```
1 //EX 8 Program Title:Determine PIV , Vdc ,Idc ,Vrms ,Pdc  
   and Irms for center tapped transformer full Wave  
   Rectifier . /  
2 ///environment: Scilab 5.5.2  
3 //Tested on OS: Windows 7 Professional , 64 bit  
4 //Book: Electronics Devices and Circuit Theory by  
   Robert Boylestead and Nashelsky  
5 ///////////////////////////////////////  
6 clc ;  
7 clear all ;  
8 close ;  
9  
10 //  
   ///////////////////////////////////////
```

```

11 disp('For Center Tapped Full Wave Rectifier Analysis
      : ');
12 RL=input('Enter the value of Load Resistance in Ohms
           RL: ');//Note:Press enter
13 Vac=input('Enter the value of Input AC Voltage in
           Volts Vac: ');//Note:Press enter
14 N1=input('Enter the Number of primary turns
           N1: ');//Note:Press enter/
15 N2=input('Enter the Number of Secondary turns
           N2: ');//Note:Press enter/
16 mprintf('\n.
           \*****
           ');
17 //
           //////////////////////////////////////
18 disp('To Analyse Center Tapped Full wave rectifier
      given data in the circuit is: ');
19 mprintf(' Load Resistance RL:%2d ohm',
           RL);
20 mprintf('\n Input AC voltage V1:%2d V',
           Vac);
21 mprintf('\n Number of Secondary turns N2:%1d ',N2
           );
22 mprintf('\n Number of Primary turns N1:%1d ',N1
           );
23 //////////////////////////////////Voltage at Secondary
           //////////////////////////////////
24 mprintf('\n. \*****Solution
           *****\ ');
25 V2=Vac*(N2/N1);//Volts RMS voltage at secondary
26 mprintf('\n 1)Voltage at Secondary is V2:%2d',V2);
27 //////////////////////////////////Maximum Value at Secondary
           //////////////////////////////////
28 mprintf('\n.
           \*****
           ');

```

```

29 Vrms=sqrt(2)*V2; //Volt maxi. secondary voltage
30 mprintf('\n 2)Maximum value of secondary voltage is
    Vrms:%2d ',Vrms);
31 mprintf('\n.
    \*****
    ');
32 Vm=Vrms/2; //Volt maxi. voltage at half of
    secondary
33 mprintf('\n 3)Maximum voltage value of half-
    secondary Winding is Vm:%2d ',Vm);
34 mprintf('\n.
    \*****
    ');
35 //Load Current
    //Load Current
36 Im=Vm/RL; // Amperes peak value of load current
37 mprintf('\n 4)Maxi.value of load Current is Im:%1f A
    ',Im);
38 mprintf('\n.
    \*****
    ');
39 Idc=(2*Vm)/(3.14*RL); //Amperes Load current
40 //Idc=Idc*1e3; //mili amperes//
41 mprintf('\n 5)Average value of Load current is Idc:
    %1f A',Idc);
42 mprintf('\n.
    \*****
    ');
43 Vdc=Idc*RL; //Volts dc Voltage
44 mprintf('\n 6)Average Value of Output Voltage is Vdc
    :%1f V',Vdc);
45 mprintf('\n.
    \*****
    ');
46 Pdc=(Idc^2)*RL; // Watts Average Power
47 mprintf('\n 7)Average Value Of load Power is Pdc:%1f
    W',Pdc);
48 mprintf('\n.

```

```

        \*****
    ');
49 PIV=2*Vm;    //Volts
50 mprintf('\n 8)Peak Inverse Voltage is PIV:%1d V',PIV
    );
51 mprintf('\n.
        \*****
    ');
52 Vr=Vdc*0.482;    //Volts  Ripple voltage
53 mprintf('\n 9)Ripple Voltage is Vr:%1f V',Vr);
54 mprintf('\n.
        \*****
    ');
55 Irms=0.707*(Vm/RL);    //Amperes RMS Value of
    Current
56 Irms=Irms*1e3;    // Mili amperes
57 mprintf('\n 10)RMS Value of current is Irms:%1f mA'
    ,Irms);
58 mprintf('\n.
        \*****
    ');
59
60 //output//
61 // For Center Tapped Full Wave Rectifier Analysis:
62 //Enter the value of Load Resistance in Ohms
    RL:1000
63 //Enter the value of Input AC Voltage in Volts
    Vac:220
64 //Enter the Number of primary turns
    N1:1000
65 //Enter the Number of Secondary turns
    N2:100
66
67 //.
    *****

68 // To Analyse Center Tapped Full wave rectifier
    given data in

```

```

69 //           the circuit is:
70 //Load Resistance           RL:1000 ohm
71 // Input AC voltage         V1:220 V
72 //Number of Secondary turns  N2:100
73 // Number of Primary turns   N1:1000
74 // . *****Solution
      *****
75 // 1) Voltage at Secondary is V2:22
76 // .
      *****

77 //2)Maximum value of secondary voltage is Vrms:31
78 // .
      *****

79 // 3)Maximum voltage value of half-secondary Winding
      is Vm:15
80 // .
      *****

81 //4)Maxi.value of load Current is Im:0.015556 A
82 // .
      *****

83 //5)Average value of Load current is Idc:0.009909 A
84 // .
      *****

85 //6)Average Value of Output Voltage is Vdc:9.908503
      V
86 // .
      *****

87 // 7)Average Value Of load Power is Pdc:0.098178 W
88 // .
      *****

89 //8)Peak Inverse Voltage is PIV:31 V

```

```
90 // .
    *****
91 // 9)Ripple Voltage is Vr:4.775898 V
92 // .
    *****
93 // 10)RMS Value of current is Irms:10.998339 mA
94 // .
    *****
```

---

## Experiment: 9

# Determine PIV, Vdc, Idc, Vrms, Pdc and Irms for center full Wave bridge Rectifier

Scilab code Solution 9.0 Determine PIV Vdc Idc Vrms Pdc and Irms for full Wave bridge Rectifier

```
1 //EX 9 Program Title:Determine PIV,Vdc,Idc,Vrms,Pdc
  and Irms for full Wave bridge Rectifier.
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional, 64 bit
4 //Book: Electronics Devices and Circuit Theory by
  Robert Boylestead and Nashelsky
5 //////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
  //////////////////////////////////////
10 disp('For Full Wave Bridge Rectifier Analysis:');
```

```

11 RL=input('Enter the value of Load Resistance in Ohms
           RL: ');//Note:Press enter
12 Vac=input('Enter the value of Input AC Voltage in
           Volts      Vac: ');//Note:Press enter
13 N1=input('Enter the Number of primary turns in trun
           ratio      N1: ');//Note:Press enter/
14 N2=input('Enter the Number of Secondary turns in
           trun ratio N2: ');//Note:Press enter/
15 mprintf('\n.
           \*****\ ');
16 //
           //////////////////////////////////////
17 disp('Given data for Full Wave Bridge Rectifier
           circuit is: ');
18 mprintf(' Load Resistance           RL:%2d ohm',RL)
           ;
19 mprintf('\n Input AC voltage           V1:%2d V',Vac
           );
20 mprintf('\n Number of Secondary turns   N2:%1d ',N2);
21 mprintf('\n Number of Primary turns     N1:%1d ',N1);
22 mprintf('\n');
23 ////////////////////////////////////Voltage at Secondary
           ////////////////////////////////////
24 mprintf('\n. \*****Solution
           \*****\ ');
25 V2=Vac*(N2/N1); // calculation of RMS secondary
26 mprintf('\n 1) Voltage at Secondary is
           V2:%1dV',V2);
27 ////////////////////////////////////Maximum Value at Secondary
           ////////////////////////////////////
28 mprintf('\n.
           \*****\ ');
29 Vrms=V2; //Volt Maxi voltage across secondary
30 mprintf('\n 2)Maximum value of secondary voltage is
           Vrms:%.1fV ',Vrms);
31 mprintf('\n.

```

```

        \*****\
        ');
32 Vm=Vrms*sqrt(2); //Volt peak value of output
33 mprintf('\n 3)Maximum voltage value of secondary
        Winding is Vm:%.1fV ',Vm);
34 mprintf('\n.
        \*****\
        ');
35 //Load Current
        //////////////////////////////////////
36 Im=Vm/RL; // Amperes peak value of output current
37 mprintf('\n 4)Maxi.value of load Current is
        Im:%.2fA ',Im);
38 mprintf('\n.
        \*****\
        ');
39 Idc=(2*Vm)/(3.14*RL); //Amperes Load current
40 //Idc=Idc*1e3; //mili amperes//
41 mprintf('\n 5)Average value of Load current is
        Idc:%.2f A',Idc);
42 mprintf('\n.
        \*****\
        ');
43 Vdc=Idc*RL; //Volts Output DC voltage
44 mprintf('\n 6)Average Value of Output Voltage is
        Vdc:%2dV',Vdc);
45 mprintf('\n.
        \*****\
        ');
46 Pdc=(Idc^2)*RL; // Watts Average Power
47 mprintf('\n 7)Average Value Of load Power is
        Pdc:%.1fW',Pdc);
48 mprintf('\n.
        \*****\
        ');
49 PIV=2*Vm; //Volts peak inverse voltage
50 mprintf('\n 8)Peak Inverse Voltage is
        PIV:%1dV',PIV);

```

```

51 mprintf( '\n.
    \*****\n
    ');
52 Irms=0.707*(Vm/RL); //Amperes RMS Value of
    Current
53 Irms=Irms*1e3; // mili amperes
54 mprintf( '\n 9)RMS Value of current is
    Irms:%.1fA ',Irms);
55 mprintf( '\n.
    \*****\n
    ');
56
57
58 //output//
59
60 //For Full Wave Bridge Rectifier Analysis:
61 //Enter the value of Load Resistance in Ohms
    RL:200
62 //Enter the value of Input AC Voltage in Volts
    Vac:230
63 //Enter the Number of primary turns in trun ratio
    N1:4
64 //Enter the Number of Secondary turns in trun ratio
    N2:1
65
66 // . *****
67 // Given data for Full Wave Bridge Rectifier circuit
    is:
68 //Load Resistance RL:200 ohm
69 //Input AC voltage V1:230 V
70 // Number of Secondary turns N2:1
71 //Number of Primary turns N1:4
72 // . *****Solution
    *****
73 // 1)Voltage at Secondary is
    V2:57V
74 // .
    *****

```

```

75 //2)Maximum value of secondary voltage is
    Vrms:57.5V
76 //.
    *****

77 // 3)Maximum voltage value of secondary Winding is
    Vm:81.3V
78 //.
    *****

79 // 4)Maxi.value of load Current is
    Im:0.41A
80 //.
    *****

81 // 5)Average value of Load current is
    Idc:0.26 A
82 //.
    *****

83 //6)Average Value of Output Voltage is
    Vdc:51V
84 //.
    *****

85 // 7)Average Value Of load Power is
    Pdc:13.4W
86 //.
    *****

87 // 8)Peak Inverse Voltage is
    PIV:162V
88 //.
    *****

89 // 9)RMS Value of current is
    Irms:287.5A

```

90 // .

\*\*\*\*\*



## Experiment: 10

# To find operating points and transfer curve of FET for fixed bias

**Scilab code Solution 10.0** To find operating points and transfer curve of FET for fixed bias

```
1 //EX 10 Program Title:To find operating points and
  transfer curve of FET for fixed bias.
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
  Robert Boylestead and Nashelsky
5 //////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
  //////////////////////////////////////
10 disp('For FET Fixed Bias Circuit: ');
11 IDSS_1=input('Enter the value of Maxi.Drain to
  Source Current in mA IDSS: ');//Note:Press enter
```

```

/
12 Vp=input('Enter the value of Pinch off voltage in
    Volt(-Ve)      Vp: ');//Note:Press enter///
    pinch off voltage is negative
13 RD_1=input('Enter the value of Drain resistance in
    Kilo Ohms      RD: ');//Note:Press enter///
14 VGG=input('Enter the value of Gate supply Voltage in
    volt(-Ve)      VGG: ');//Note:Press enter///Gate
    supply voltage is negative
15 VDD=input('Enter the value of Drain supply Voltage
    in volt        VDD: ');//Note:Press enter///Gate
    supply voltage is negative
16 mprintf('\n
    .*****\
    ');
17 disp('Given data for FET Fixed Bias is:');
18 IDSS=IDSS_1*1e-3 // mili amperes Maxi Drain to
    Source Current
19 RD=RD_1*1e3 // kilo ohm Emitter Resistance
20 mprintf(' Maximum Drain Current      IDSS:%.3fA ',IDSS)
    ;
21 mprintf('\n Pinch-off voltage          Vp:%2dV ',Vp);
22 mprintf('\n Drain Resistance            RD:%2dOhms ',RD)
    ;
23 mprintf('\n Supply Voltage                VDD:%2dV ',VDD);
24 mprintf('\n Gate Supply Voltage            VGG:%.1fV ',VGG)
    ;
25 ////////////////Voltage at Secondary
    //////////////////////////////////////
26 mprintf('\n
    .*****\
    ');
27 mprintf('\n **** Shockley Equation:ID=IDSS*(1-VGS/VP)
    ^2***** ');//Shockley Equation
28 mprintf('\n.
    \
    \n ');
29 VGS=[0:-0.01:Vp];

```

```

30 ID=IDSS*(1-VGS/Vp).^2; //drain current using
    shockley equation
31 figure(2),plot(VGS,ID,'red');// plot of transfer
    characteristics
32 xtitle("Transfer characteristics of FET","VGS (V)","
    ID (mA)");
33 ///////////////////////////////////Calculatin of VDSQ and IDQ
    ///////////////////////////////////
34 VGSQ=VGG;
35 IDQ=IDSS*(1-VGSQ/Vp).^2; // Drain Current
    Calculation
36 VDSQ=VDD-(IDQ*RD); // Drain to Sourse voltage
    Calculation
37 IDQ=IDQ*1e3; /// mili ampere conversion
38 mprintf('1)Operating Point Drain To Source Voltage
    VDSQ:%.2 f V',VDSQ);//Display
39 mprintf('\n 2)Operating Point Drain Current
    IDQ:%.2 f mA',IDQ);
40 mprintf('\n.
    \*****\
    ');
41
42 //Output///
43 //For FET Fixed Bias Circuit:
44 //Enter the value of Maxi.Drain to Sourse Current in
    mA IDSS:12
45 //Enter the value of Pinch off voltage in Volt(-Ve)
    Vp:-4
46 //Enter the value of Drain resistance in Kilo Ohms
    RD:1.2
47 //Enter the value of Gate supply Voltage in volt(-Ve
    ) VGG:-1.5
48 //Enter the value of Drain supply Voltage in volt
    VDD:12
49
50 //
    .*****

```

```

51 //Given data for FET Fixed Bias is :
52 // Maximum Drain Current      IDSS:0.012A
53 //Pinch-off voltage           Vp:-4V
54 // Drain Resistance            RD:1200Ohms
55 //Supply Voltage              VDD:12V
56 //Gate Supply Voltage         VGG:-1.5V
57 //
      .*****
58 // ****Shockley Equation:ID=IDSS*(1-VGS/VP)
      ^2*****
59 //.
      *****
60 // 1)Operating Point Drain To Source Voltage      VDSQ
      :6.38 V
61 // 2)Operating Point Drain Current                IDQ
      :4.69 mA
62 //.
      *****

```

---

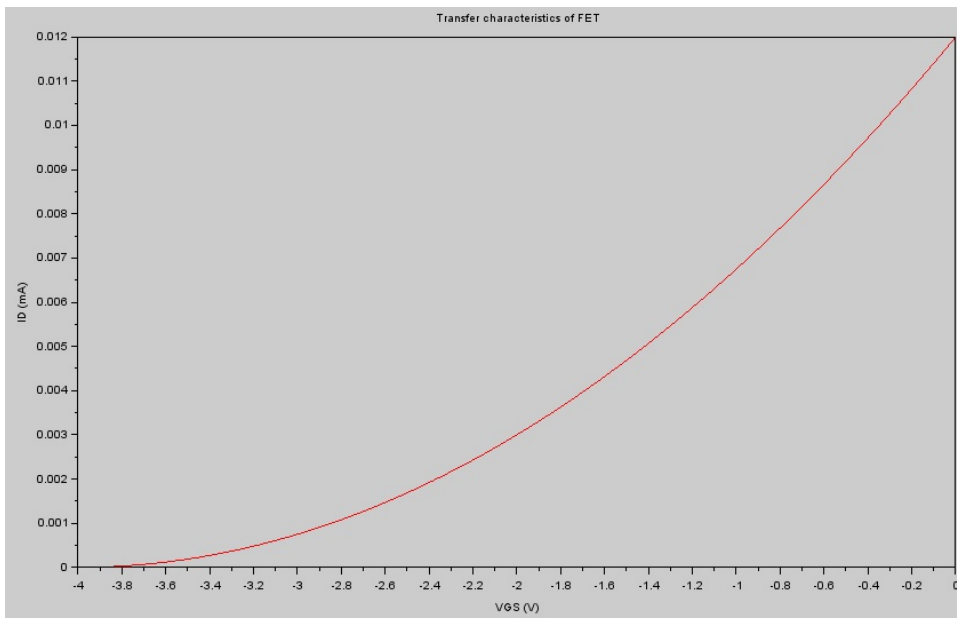


Figure 10.1: To find operating points and transfer curve of FET for fixed bias

# Experiment: 11

## To find operating points of BJT for voltage divider bias

Scilab code Solution 11.0 To find operating points of BJT for voltage divider bias

```
1 //EX 11 Program Title:To find operating points of
  BJT for Voltage Divider bias./////
2 //environment: Scilab 5.5.2
3 //Tested on OS: Windows 7 Professional , 64 bit
4 //Book: Electronics Devices and Circuit Theory by
  Robert Boylestead and Nashelsky
5 ///////////////////////////////////////////////////////////////////
6 clc;
7 clear all;
8 close;
9 //
  ///////////////////////////////////////////////////////////////////

10 disp('For BJT Voltage Divider Bias: ');
11 R1_1=input('Enter the value of Base resisance 1 in
  Kilo Ohms R1: ');//Note:Press enter/
12 R2_1=input('Enter the value of Base resistance 2 in
  Kilo Ohms R2: ');//Note:Press enter/
```

```

13 RC_1=input('Enter the value of Collector resistance
    in Kilo Ohms    RC:');//Note:Press enter///
    collector resistance value should bel less than
    R1 and R2
14 RE_1=input('Enter the value of Emitter resistance
    in Kilo Ohms    RE:');//Note:Press enter///
    Emitter Resistance value should be less than
    collector resistanc
15 Betadc=input('Enter the value of Beta
                Betadc:');//Note:
    Press enter/
16 VCC=input('Enter the Supply Voltage in Volts
            VCC:');//Note:Press enter
    /
17 R1=R1_1*1e3    // Kilo ohms  Base resistance 1
18 R2=R2_1*1e3    // Kilo ohms  base resistance 2
19 RC=RC_1*1e3    // Kilo ohms  Collector resistance
20 RE=RE_1*1e3    // kilo ohm  Emitter Resistance
21 //C1 uf input capaciance open circuited in DC
    analysis
22 //C2 uf output capaciance open circuited in DC
    analysis
23 VBE=0.7 //Volts Base to Emitter voltage
24 mprintf('\n.
    \*****\');
25 disp('Given data for BJT Voltage Divider Bias is:')
    ;
26 mprintf(' Base resistance 1          R1:%.2f Ohms',R1)
    ;
27 mprintf('\n Base resistance 2          R2:%2d Ohms',R2
    );
28 mprintf('\n Collector resistance      RC:%2d Ohms',RC
    );
29 mprintf('\n Emitter resistance        RE:%2d Ohms',RE
    );
30 mprintf('\n CE DC Current Gain        Betadc:%2d V',
    Betadc);
31 mprintf('\n Collector Supply Voltage VCC:%2d V',VCC)

```

```

;
32 mprintf('\n Base to Emitter Voltage VBE:%.1f V',VBE
);
33 //////////////////////////////////////////////////Calculation of IB current to find
out ICQ////////////////////////////////////
34 mprintf('\n.
\*****\ ');
35 Rth=(R1*R2)/(R1+R2); // Thevenin Equivalent
Resistance
36 Vth=(R2*VCC)/(R1+R2); /// Open Circuit Thevenin
Voltage
37 IB=(Vth-VBE)/(Rth+(Betadc+1)*RE);// Base Current
38 IB_=IB*1e6 // ampere for display
39 mprintf('\n Thevenin Equivalent Resistance Rth:
%2d Ohms',Rth);
40 mprintf('\n Open Circuit Thevenin Voltage Vth:%
.2f V',Vth);
41 mprintf('\n Base Current IB:%.2
f uA',IB_);
42 //////////////////////////////////////////////////Calculatin of ICQ and VCEQ
////////////////////////////////////
43 mprintf('\n.
\*****\ ');
44 ICQ=Betadc*IB; // Collector cueurnt
45 ICQ_=ICQ*1e3 // ampere for display
46 VCEQ=VCC-ICQ*(RC+RE); // collector to emitter
voltage
47 mprintf('\n Operating Point Collector To Emitter
Voltage VCEQ:%.2f V',VCEQ);//Display
48 mprintf('\n Operating Point Collector Current
ICQ:%.4f mA',ICQ_);
49
50 ///output////
51
52
53 // For BJT Voltage Divider Bias:
54 //Enter the value of Base resisance 1 in Kilo Ohms
R1:82

```

```

55 //Enter the value of Base resistance 2 in Kilo Ohms
      R2:22
56 //Enter the value of Collector resistance in Kilo
      Ohms   RC:5.6
57 //Enter the value of Emitter resistance in Kilo
      Ohms   RE:1.2
58 //Enter the value of Beta
                                   Betadc:50
59 //Enter the Supply Voltage in Volts
                                   VCC:18
60
61 // . *****
62 // Given data for BJT Voltage Divider Bias is :
63 // Base resistance 1           R1:82000.00 Ohms
64 // Base resistance 2           R2:22000 Ohms
65 // Collector resistance       RC:5600 Ohms
66 // Emitter resistance         RE:1200 Ohms
67 // CE DC Current Gain        Betadc:50 V
68 // Collector Supply Voltage  VCC:18 V
69 // Base to Emitter Voltage    VBE:0.7 V
70 // . *****
71 // Thevenin Equivalent Resistance Rth:17346 Ohms
72 // Open Circuit Thevenin Voltage Vth:3.81 V
73 // Base Current               IB:39.57 uA
74 // . *****
75 // Operating Point Collector To Emitter Voltage
      VCEQ:4.55 V
76 // Operating Point Collector Current
      ICQ:1.9783 mA

```

---

# Appendix

## Scilab code AP 1

```
1 function [ID,x,VT]=diode_current2(VD,TK)
2 k=1.38e-23 //Joule per Kelvin Boltzmann's
   Constant
3 q= 1.6e-19 // coulomb Magnitude
   of electronics charge
4 Is=10e-12 // Amper Reverse
   saturation current
5 n=1 // Ideality
   factor
6 ///////////////////////////////////////////////////////////////////
7 VT=(k*TK)/q;
8 x=VD/(n*VT);
9 //
   ///////////////////////////////////////////////////////////////////
10 ID=Is*(exp(x)-1);
11 endfunction

input
```

---