# Scilab Manual for Electronics Devices and Circuit I by Dr Ravindra Chandu Patil Electronics and Telecommunication Engineering M. H. Saboo Siddik College Of Engineering[1]

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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 ID=Is*(e^(VD/n*VT)-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:%.3f
       nA',Is1);
26 mprintf('\n Boltzmanns Constant..                    k:%.5f
      zJ/K',k1);
27 mprintf('\n Electron charge..                        q:%.2f
      aC',q1);
28 mprintf('\n Forward bias voltage                     VD:%.2f
       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;
```

```
clear all;
close;
xdel(winsid());///clear all the previous figures plots
////////////////////////////Forward Bias Characterisices//////////////////////////////
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
VD=[0:0.01:VD_fw];                    // Change in input volatage
ID=10e-12*(exp(VD/0.039)-1);  // Diode current equation
ID=ID*1e3;                          // Diode Current in miliampere
figure(1),plot(VD,ID,'*');// plotting VD and ID
xtitle("Diode Forward Bias characteristics","Diode Voltage VD (V)","Diode Current ID (mA)");//plot
////////////////////////////Reversed Biased Characteristics//////////////////////////////
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
VDr=[0:-0.01:-VD_rev];                    // Change in input volatage
IDr=-10e-12*(exp(VD/0.039)-1);  // Diode current equation
IDr=IDr*1e3;                          // Diode Current in miliampere
figure(2),plot(VDr,IDr,'*');// plotting -VD and -ID
xtitle(" Diode Reversed Bias characteristics","Diode Voltage -VD (V)","Diode Current -ID (mA)");//plot


//output
```

```
29
30
31 //Enter the Maximum Forward Voltage for input:5
32 //Enter the Maximum Reverse Voltage for input:5
```

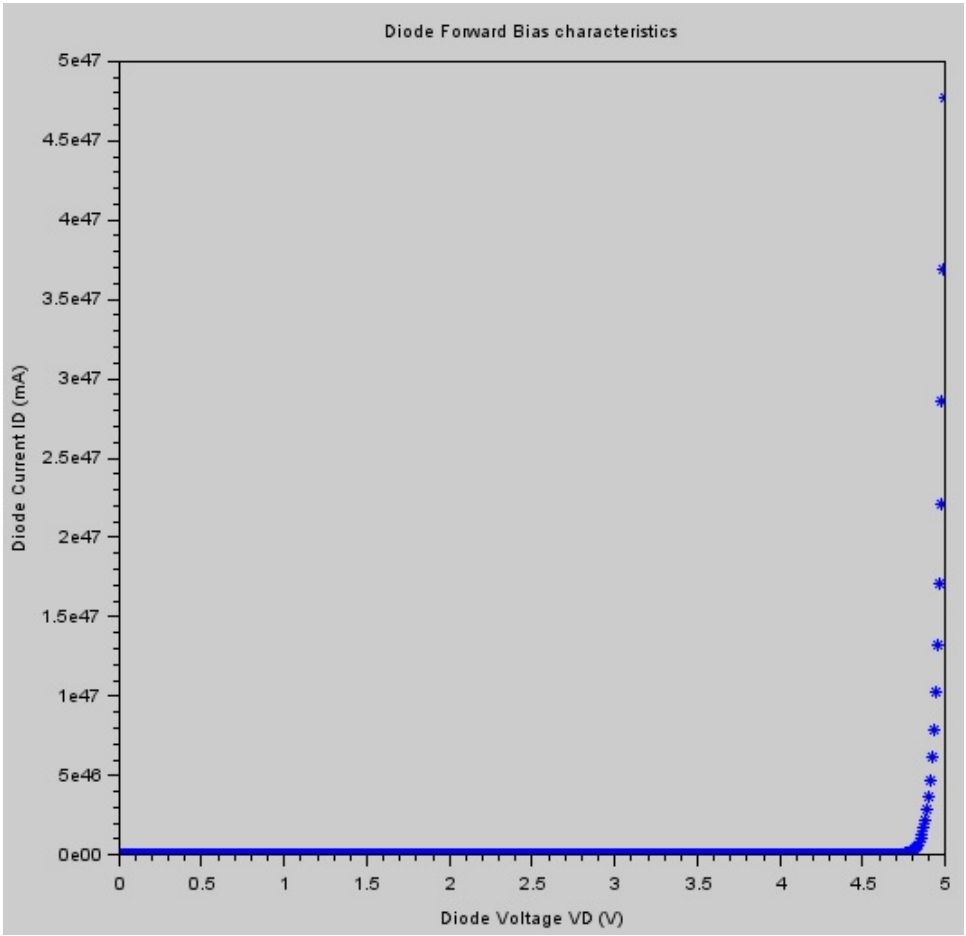



Figure 2.1: To Plot the VI Characteristics of semiconductor diode under forward Bias using Shockley equation

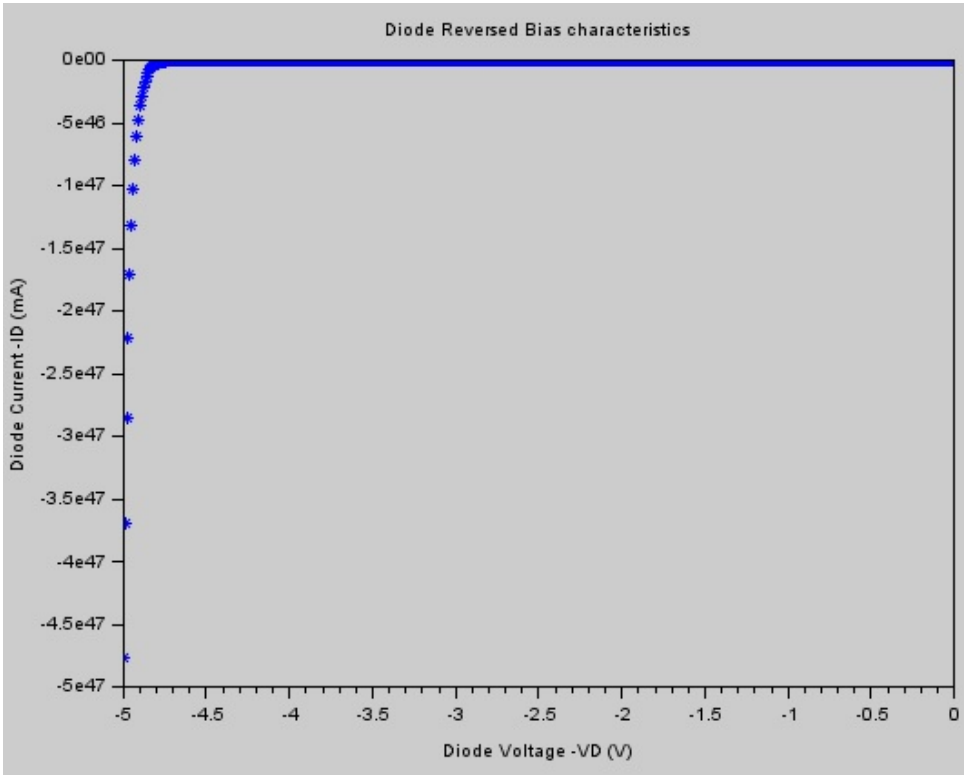



Figure 2.2: To Plot the VI Characteristics of semiconductor diode under forward Bias using Shockley equation

# 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:%.4f A',ID11)
    ;
33 mprintf('\n Diode current2        ID12:%.4f 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:%.2f V',VD11
    );
44 mprintf('\n Diode Voltage2         VD12:%.2f 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 //
```

```
//**********************************************************************

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


///case2/////////
//*******DC resistances of diode can be calculated by using
//       operating points on the forward characteristic*******
//       **
//Enter the value of ID on the curve in mA ID:25
//Enter the Corresponding value of VD on the curve in V VD:.7

 //
  ******************************************************

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

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

//
//**********************************************************

// For calculation of AC resistance at the operating points ID
//Diode current1        ID11:0.0230 A
//Diode current2        ID12:0.0270 A
// 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 desiging 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 trhough input
      resistance
32 IR=IR*1e3;  //amperes
33 mprintf('\n.
      \**********************************************************\
      ');
34 mprintf('\n 3)Current through Input Reistance R is
           IR:%.4fmA',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=%.3fA',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 desiging 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 Cuuent
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 Cuuent
```

```
33 IR_maxD=IR_max*1e3;  // miliamper
34 mprintf('\n.
   \**********************************************************
   ');
35 mprintf('\n 3)Current through input Reistance 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
    =12.500000mA
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 Betadc and Betaac 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 Recspective 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=%.2f uA'
      ,ib1);
33 mprintf('\n  Base current2                ib2=%.2f 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=%.2
      f mA',ic1);
40 mprintf('\n  Collector current2              ic2=%.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 mprintf('\n  Collector to emitter voltage1
                  vce1=%2d v',vce1);
52 mprintf('\n  Collector to emitter voltage2
                  vce2=%2d v',vce2);
53 mprintf('\n.
   \**********************************************************\
   ');
54 R_out=(vce2-vce1)/(ic2-ic1);// AC resistance
55 R_out=R_out*1e-3; // Kilo ohms
56 mprintf('\n 3)Dynamic Output resistance  is
                    R_out:%1dKohm',R_out);
57 mprintf('\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 // Recspective 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  ac
   ****************
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
      ////////////////////////////////
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.
```

```
    \**************************************************\
    ');
Vm=Vrms*sqrt(2); //Volt peak value of output
mprintf('\n 3)Maximum voltage value of secondary
   Winding is  Vm:%.1fV ',Vm);
mprintf('\n.
    \**************************************************\
    ');
//////////////Load Current
   ////////////////////////////////
Im=Vm/RL;    // Amperes peak value of output current
mprintf('\n 4)Maxi.value of load Current is
                      Im:%.2fA',Im);
mprintf('\n.
    \**************************************************\
    ');
Idc=(2*Vm)/(3.14*RL);     //Amperes Load current
//Idc=Idc*1e3;  //mili amperes//
mprintf('\n 5)Average value of Load current is
                    Idc:%.2f A',Idc);
mprintf('\n.
    \**************************************************\
    ');
Vdc=Idc*RL;    //Volts  Output DC voltage
mprintf('\n 6)Average Value of Output Voltage is
                  Vdc:%2dV',Vdc);
mprintf('\n.
    \**************************************************\
    ');
Pdc=(Idc^2)*RL;     // Watts Average Power
mprintf('\n 7)Average Value Of load Power is
                     Pdc:%.1fW',Pdc);
mprintf('\n.
    \**************************************************\
    ');
PIV=2*Vm;    //Volts  peak inverse voltage
mprintf('\n 8)Peak Inverse Voltage is
                              PIV:%1dV',PIV);
```

```
51 mprintf('\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.
      \**************************************************\
      ');
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
    Sourse 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:%.2f V',VDSQ);//Display
39 mprintf('\n 2)Operating Point Drain Current
                  IDQ:%.2f 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 //.
    *****************************************************
```

---

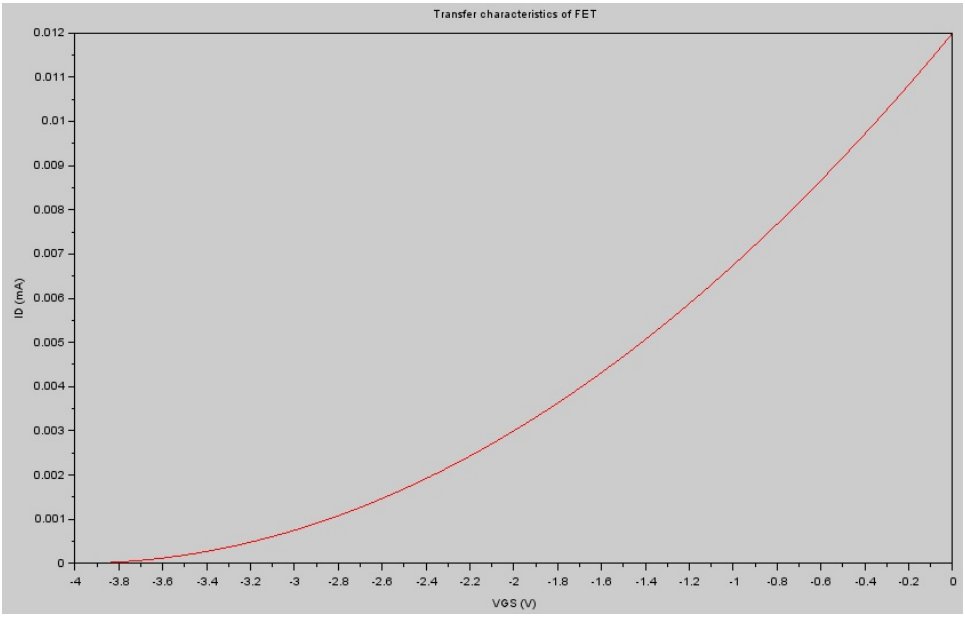



Figure 10.1: To find operating points and transfer curve of FET for fixed bias

# 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 cueernt
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          // columb                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