Scilab Manual for
Electronic Devices and Circuits
by Prof Mrugendra Vasmatkar
Others
VESIT[1]

Solutions provided by
Mr Ajinkya Khair
Others
VESIT

April 6, 2026

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website http://scilab.in

Contents

List of Experiments

Experiment: 1

To find the transfer characteristics of FET

Scilab code Solution 1.1 transfer characteristics of FET

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

IDSS=12;        // in mili-amperes
VP=-5;          // in volts

// Plotting transfer curve
VGS=[0:-0.01:VP];    // Gate source voltage in volts
// Using Shockley's equation
ID=IDSS*(1-VGS/VP).^2;     // Drain current in mili-
    amperes
plot(VGS,ID);
xtitle("Transfer Curve","VGS (V)","ID (mA)");
```

Scilab code Solution 1.2 transfer characteristics of FET

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

IDSS=15;       // in mili-amperes
VP=-4;         // in volts

// Plotting transfer curve
VGS=[0:-0.01:VP];    // Gate source voltage in volts
// Using Shockley's equation
ID=IDSS*(1-VGS/VP).^2;      // Drain current in mili-amperes
plot(VGS,ID);
xtitle("Transfer Curve","VGS (V)","ID (mA)");
```

Experiment: 2

To find the transfer characteristics of FET for self bias configuration

Scilab code Solution 2.1 transfer characteristics of FET for self bias

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

IDSS=5e-3; // in amperes
VP=-5; // in volts

// input circuit parameters
VDD=15; // in volts
RD=2.2e3; // in ohms
RS=1.6e3; // in ohms

// Plotting transfer characteristics
VGS=[0:-0.01:VP]; // Gate source voltage in volts
// Using Shockley's equation
ID=IDSS*(1-VGS/VP).^2; // Drain current in amperes
ID=ID*1e3; // Drain current in mili-amperes
```

```
plot(VGS,ID);
xtitle("Transfer Characteristics","VGS (V)","ID (mA)");

// Plotting bias line
// From gate source circuit
ID=-VGS/RS; // Source current in amperes
ID=ID*1e3; // Source current in mili-amperes
plot(VGS,ID,"RED");

// Intersection of transfer characteristics with the bias curve
// Putting VGS = -ID*RS in Shockley's equation and solving, we get ID^2*RS^2 + (2*RS*VP - VP^2/IDSS)*ID + VP^2
// Solving the equation
p_eq = poly([VP^2 (2*RS*VP-VP^2/IDSS) RS^2],"x","coeff");
p_roots= roots(p_eq);
IDQ=p_roots(1); // in amperes
// Writing the KVL for the output loop
VDSQ=VDD-IDQ*(RD+RS); // in volts
VS=IDQ*RS; // in volts
VD=VDSQ+VS; // in volts
IDQ=IDQ*1e3; // in mili-amperes
disp(VDSQ,"VDSQ (V) =");
disp(IDQ,"IDQ (mA) =");
disp(VD,"VD (V) =");
disp(VS,"VS (V) =");
```

Experiment: 3

To find operating point of FET

Scilab code Solution 3.1 operating point of FET

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

VP=-5;        // in volts
IDSS=18e-3; // in amperes

// input circuit parameters
VDD=18; // in volts
R1=400; // in kilo-ohms
R2=90;  // in kilo-ohms
RD=2e3; // in ohms
RS=2e3; // in ohms
// Applying Thevnin's theorem
VGG=VDD*R2/(R1+R2);    // in volts

// Plotting transfer characteristics
VGS=[VGG:-0.01:VP];    // Gate source voltage in
    volts
// Using Shockley's equation
ID=IDSS*(1-VGS/VP).^2; // Drain current in amperes
```

```
ID=ID*1e3; // Drain current in mili-amperes
plot2d(VGS,ID,rect=[-5,0,3,12]);
xtitle("Transfer Characteristics","VGS (V)","ID (mA)");

// Plotting bias line
// From the KVL for the gate-loop
ID=(-VGS+VGG)/RS; // Source current in amperes
ID=ID*1e3; // Source current in mili-amperes
plot(VGS,ID,"RED");

// Intersection of transfer curve with the bias curve
// Putting VGS = VGG-ID*RS in Shockley's equation and solving, we get
// ID^2*RS^2 + (2*RS*VP - 2*VGG*RS - VP^2/IDSS)*ID + (VGG-VP)^2
// Solving the equation
p_eq = poly([(VGG-VP)^2 (2*RS*VP-2*VGG*RS-VP^2/IDSS) RS^2],"x","coeff");
p_roots= roots(p_eq);
IDQ=p_roots(1); // in amperes
// Writing the KVL for the drain source loop
VDSQ=VDD-IDQ*(RD+RS); // in volts
IDQ=IDQ*1e3; // in mili-amperes
disp(VDSQ,"VDSQ (V) =");
disp(IDQ,"IDQ (mA) =");
```

Experiment: 4

To find the transfer characteristics of n channel enhancement type MOSFET

Scilab code Solution 4.1 transfer characteristics of n channel enhancement type MOSFET

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

ID=6e-3; // in amperes
VGS=8;   // in volts
VT=3;    // in volts
// input circuit parameters
VDD=12; // in volts
RD=2e3; // in ohms

// Plotting transfer curve
k=ID/(VGS-VT).^2;  // in amperes per volt square
VGS=[3:0.01:VDD]; // Gate source voltage in volts
ID=k*(VGS-VT).^2;  // Drain current in amperes
    ...........(1)
```

```
ID=ID*1e3; // Drain current in mili-amperes
plot(VGS,ID);
xtitle("Transfer Curve","VGS (V)","ID (mA)");

// Plotting bias line
// From the simplified dc equivalent circuit
VGS=[0:0.01:VDD]; // Gate source voltage in volts
ID=(VDD-VGS)/RD;  // Source current in amperes
ID=ID*1e3; // Source current in mili-amperes
plot(VGS,ID,"RED");

// Intersection of transfer curve with the bias curve
// Putting VGS = VDD-ID*RD in equation (1) and solving, we get ID^2*RD^2 + (2*RD*VT - 2*VDD*RD - 1/k)*ID + (VDD-VT)^2
// Solving the equation
p_eq = poly([(VDD-VT)^2 (2*RD*VT-2*VDD*RD-1/k) RD^2],"x","coeff");
p_roots= roots(p_eq);
IDQ=p_roots(1);  // in amperes
VGSQ=VDD-IDQ*RD; // in volts
IDQ=IDQ*1e3;     // in mili-amperes
disp(VGSQ,"VDSQ (V) =");
disp(IDQ,"IDQ (mA) =");
```

Experiment: 5

To find operating point of MOSFET

Scilab code Solution 5.1 operating point of MOSFET

```
clc;
close;
//Scilab 5.5.0;64 bit(windows 7)

ID=5e-3; // in amperes
VGS=6;   // in volts
VT=3;    // in volts

// input circuit parameters
VDD=24;   // in volts
R1=10;    // in mega-ohms
R2=6.8;   // in mega-ohms
RD=2.2e3; // in ohms
RS=0.75e3;// in ohms
// Applying Thevnin's theorem
VGG=VDD*R2/(R1+R2); // in volts

// Plotting transfer characteristics
k=ID/(VGS-VT).^2;    // in amperes per volt square
```

```
VGS=[3:0.01:VGG];    // Gate source voltage in volts
ID=k*(VGS-VT).^2;     // Drain current in amperes ............ (i)
ID=ID*1e3; // Drain current in mili-amperes
plot(VGS,ID);
xtitle("Transfer Characteristics","VGS (V)","ID (mA)");

// Plotting bias line
VGS=[0:0.01:VGG]; // Gate source voltage in volts
// Writing KVL for the gate-source loop
ID=(VGG-VGS)/RS; // Source current in amperes
ID=ID*1e3;       // Source current in mili-amperes
plot(VGS,ID,"RED");

// Intersection of transfer curve with the bias curve
// Putting VGS = VGG-ID*RD in equation (i) and solving, we get ID^2*RS^2 + (2*RS*VT - 2*VGG*RS - 1/k)*ID + (VGG-VT)^2
// Solving the equation
p_eq = poly([(VGG-VT)^2 (2*RS*VT-2*VGG*RS-1/k) RS^2],"x","coeff");
p_roots= roots(p_eq);
IDQ=p_roots(1); // in amperes
VGSQ=VGG-IDQ*RS; // in volts
// From the output circuit
VDSQ=VDD-IDQ*(RD+RS); // in volts
IDQ=IDQ*1e3; // in mili-amperes
disp(IDQ,"IDQ (mA) =");
disp(VDSQ,"VDSQ (V) =");
disp(VGSQ,"VGSQ (V) =");
```