#Assignment 4
FIELD EFFECT TRANSISTOR

1. Explain the construction and working principle of JFET.
2. Explain the construction and working principle of D-MOSFET and E-MOSFET.
3. Difference between the JFET and bipolar Transistor (BJT).
4. Difference between the JFET and MOSFET.
5. Describe in your own words why I_G is effectively 0A for a JFET transistor.
6. Sketch the transfer and drain characteristics of an n-channel depletion-type MOSFET with I_{DSS} = 12 mA and V_p = -8 v for a range of V_{GS} = -V_P to V_{GS} = 1V.
7. What is the significant difference between the construction of an enhancement-type MOSFET and a depletion-type MOSFET?
8. For the fixed-bias configuration of Fig.1
   a. Sketch the transfer characteristics of the device.
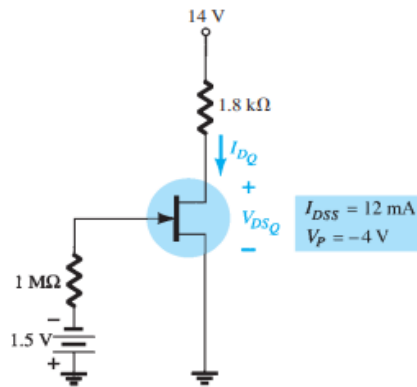   b. Determine the I_D and V_{DS}.

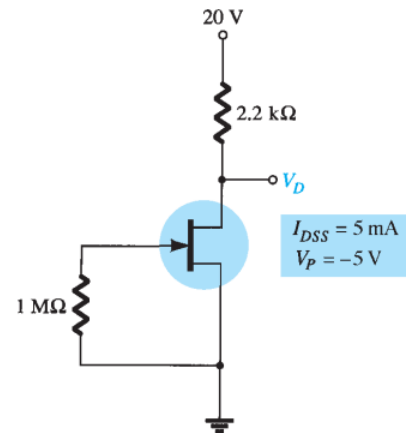|	
Figure 1	figure 2

9. Determine the V_D and V_{GS} for the fixed bias configuration of Fig.2.
10. Given the measurement V_s = 1.7 v for the network of Fig.3
    a. I_D
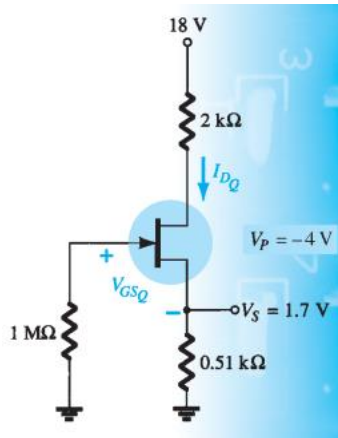   b. V_{GS} and V_{DS}.
    c. I_{DSS} and V_D
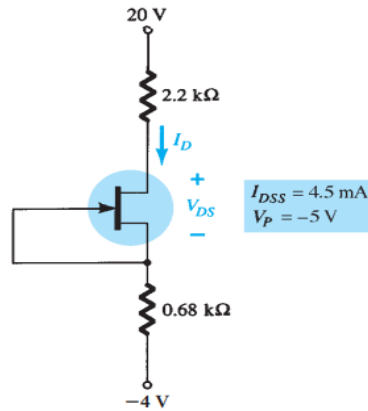
Figure 3

figure 4

11. For the network of Fig.4, determine:
   a. I_D and V_{DS}
   b. V_D and V_S

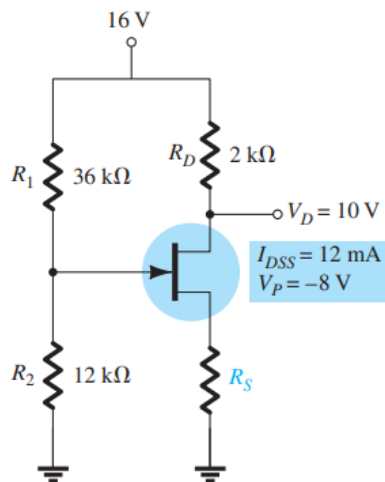12. Determine the value of R_S for the network of Fig.5 to establish $V_D = 10$ V.
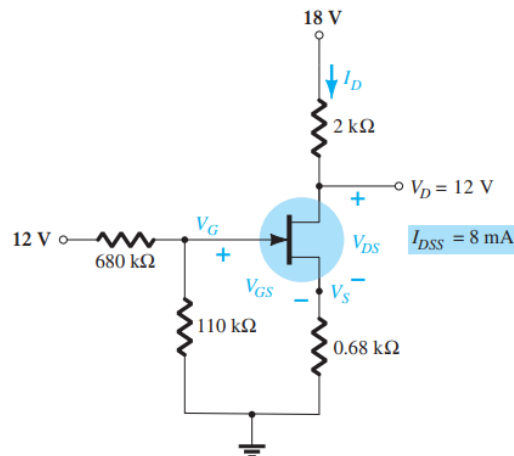

Figure 5

figure 6

13. For the network of Fig.6, $V_D = 12$ V. Determine:
   a. I_D, V_S, V_{DS}, V_G, V_{GS}, and V_P.

14. For the network of Fig.7, Determine:
   a. I_D and V_{GS}
   b. V_{DS} and V_S.

18 V

2.2 kΩ

$I_{DSS} = 8$ mA
$V_P = -8$ V

0.39 kΩ

−4 V

V_{GS_Q}

I_{D_Q}

Figure 7

24 V

10 MΩ

2.2 kΩ

I_{D_Q}

$V_{GS(Th)} = 3$ V
$I_{D(on)} = 5$ mA
$V_{GS(on)} = 6$ V

6.8 MΩ

0.75 kΩ

V_{GS_Q}
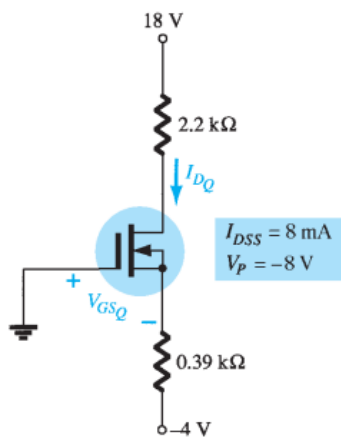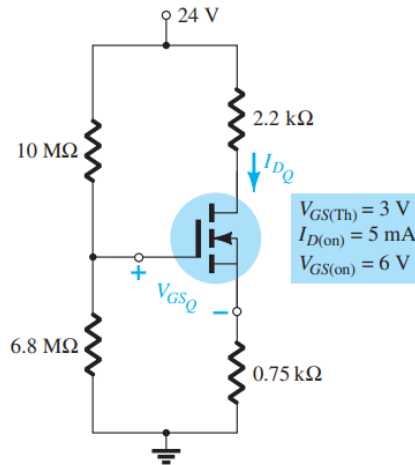
figure 8

15. For the voltage-divider configuration of Fig.8, Determine:
   a. I_D and V_{GS}
   b. V_{DS} and V_S

16. Determine the Z_i, Z_O, and A_V for the network of Fig.9 if $I_{DSS} = 10$mA, $V_P = -6$V, and $r_d = 40$ KΩ.

+18 V

R_D 1.8 kΩ

V_o

V_i

Z_o

1 MΩ R_G

Z_i

1.5 V

Figure 9

+20 V

2 kΩ

82 MΩ

V_o

V_i

$I_{DSS} = 12$ mA
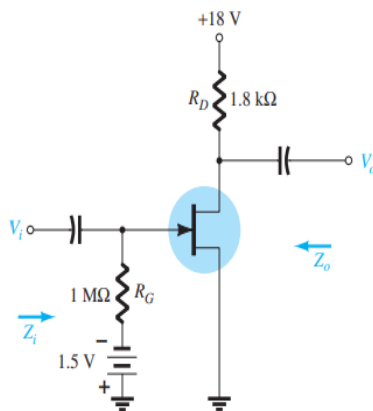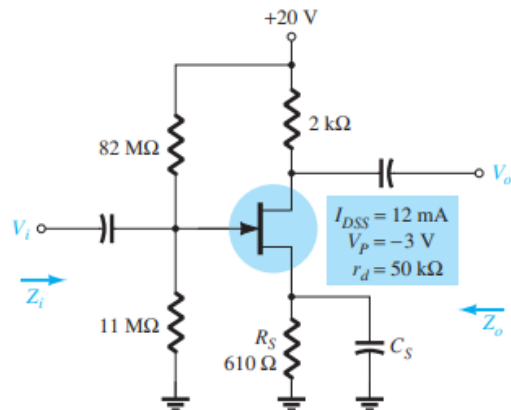$V_P = -3$ V
$r_d = 50$ kΩ

Z_i

11 MΩ

R_S
610 Ω

C_S

Z_o

figure 10

17. Determine the Z_i, Z_O, and V_O for the network of Fig. 10 if $V_i = 20$mV.
18. Derive the expression of transconductance of the JFET.
19. Determine the transconductance g_m for the MOSFET if $V_{GS(Th)} = 3$V and it is biased at $V_{GSQ} = 8$ V. Assume k = 0.3x 10^{-3}.
20. Determine the value of g_m for JFET ($I_{DSS} = 8$mA, $V_P = -5$V) when biased at $V_{GSQ} = V_P/4$.