Lab 6
JFET Characteristics

Purpose
In this lab, the characteristics of JFET will be investigated. Both the output and the trans-conductance characteristic curves will be investigated.

Material and Equipment
NI ELVIS
Regulated Power Supply
NTE 312 N Channel JFET

Theory
JFET(Junction Field Effect Transistor) is a three terminal device(drain, source, gate) similar to BJT. The difference between them is that the JFET is a voltage controlled device, whereas BJT is a current controlled device.

Drain Characteristics:
Whereas for BJT the relationship between an output parameter, $i_C$, and an input parameter, $i_B$, is given by a constant $\beta$, the relationship in JFET between an output parameter, $i_D$, and an input parameter, $v_{GS}$, is more complex. In the saturation region, there exists a square-law transfer relationship.

Transconductance Characteristics:
In the transfer characteristics of a two port network, the input parameter is changed and its effect on the output parameter is observed. Similarly JFET can be treated as a two-port nonlinear network. The transfer characteristics wherein the input parameter is the voltage across gate and source, and the output parameter is the drain current are called the trans-conductance characteristics. The transfer gain is nothing but conductance, hence the name.
**Procedure**

1) **Measuring \( I_D \) versus \( V_{DS} \) (Output Characteristics)**

   a) Build the circuit as in Figure 6-2.
   b) Obtain the output characteristics i.e. \( I_D \) versus \( V_{DS} \)
   c) Set a particular value of voltage for \( V_{GS} \). Vary the voltage across drain(\( V_{DS} \)) from 0 to 8 V with steps of 0.5 V and measure the corresponding drain current (\( I_D \)).
   d) Repeat the procedure for different values of \( V_{GS} \). (0V, -0.5V, -1V, -1.5V, -2V)
   e) Plot the graph.

2) **Measuring \( I_D \) versus \( V_{GS} \) (Transconductance Characteristics)**

   a) For the same circuit, obtain the transconductance characteristics. i.e. \( I_D \) versus \( V_{GS} \).
   b) Set a particular value of voltage for \( V_{DS} \), i.e. 5V. Start with a gate voltage \( V_{GS} \) of 0 V, and measure the corresponding drain current(\( I_D \)). Then decrease \( V_{GS} \) in steps of 0.25 V until \( V_{GS} \) is -3V. At each step record the drain current.
   c) Plot the graph with \( I_D \) versus \( V_{GS} \) using Excel or some other program.
   d) Calculate the transconductance parameter from the graph assuming your \( V_{GSQ} \) value is -1 volts.

**Questions for the Lab Report**

Use all of the data obtained to answer the following questions:

1) Discuss the output and transconductance curves obtained in lab? Are they what you expected?
2) Are the output characteristics spaced evenly? Should they be?
3) What are the applications of JFET?