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Faculty of Engineering
Electrical and Electronics Engineering

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EEM 303 Electronic II Laboratory 4

JFET Characteristics

	Student Name	Student ID	Group Number
1.			
2.			
3.			
4.			

Objective:

To understand input and output characteristics of JFETs

Equipment will be available at the laboratory:

DC power supply, Oscilloscope, Electronic Training Set(Y-0016), Patch wires,

Equipment will be ensured by students:

Digital Multi-Meter

Preliminary Work:

Read the laboratory sheets. There might be a test or classical exams in the beginning of each laboratory hour. Questions will be asked mostly from *Supplementary Information* and *Procedure* sections.

A brief summary of JFET basics and formulations should be documented into A4 paper and given to instructor(s) at beginning of laboratory hour.

Supplementary Information:

There are two principle types of transistors: bipolar transistors (BJTs), and field-effect transistors (FETs). The physical mechanisms underlying the operation of these two types of transistors are quite different. FETs are subdivided into two major classes: junction field-effect transistors (JFETs) and metal-oxide-semiconductor field-effect transistors (MOSFETs). Each type of FET is further subdivided into n-channel and p-channel FETs, and, for MOSFETs, enhancement and depletion MOSFETs.

JFET is a majority charge carrier device hence it has less noise. Also, it is a low power consumption device which has high input impedance (~100MΩ). The JFETs occupies less space in circuits due to its smaller size. It is relatively more immune to radiation. Moreover, JFETs has negative

temperature coefficient of resistance, so they possess higher Temperature Stability. As a disadvantage, the performance of JFET go downs as frequency increases due to feedback by internal capacitance.

JFETs has three terminals, a *voltage* on the gate terminal is used to control a *current* between two other terminals named the source and the drain. Gate voltage is referenced to the Source. Thus, V_{GS} refers to the voltage between the gate and the source, V_{DS} is the voltage between the drain and the source, I_D is the current into the drain, and I_S is the current out of the source. Under normal operating conditions**,** *no current flows into the gate.* Consequently $I_S = I_D$.

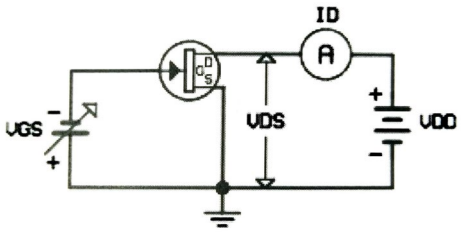

Figure 1: basic input characteristic circuit of JFETs

Procedure:

1. Insert the Y-0016-011 module into training set.
2. Connect the patch wires to the module as it is shown in Figure 2.
3. Turn the power on for Y-0016 Training Set.

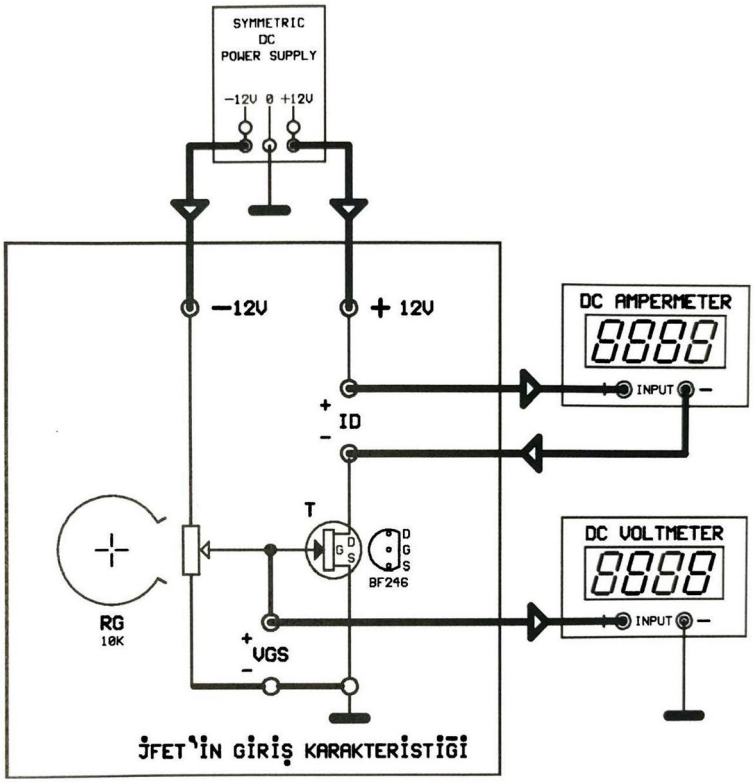

Figure 3: Connection scheme of JFET input characteristic circuit.

Input Characteristics of JFETs

4. Adjust the V_{GS} voltages in order to the values in Figure 5 by using the RG potentiometer,
5. Record I_D values respectively to the table in the Figure 5,
6. Turn the power off for Y-0016 Training Set.
7. Sketch the V_{GS} and the I_D values into Figure 5.

Output Characteristics of JFETs

8. Connect the patch wires to the module as it is shown in Figure 4.
9. Turn the power on for Y-0016 Training Set.
10. Adjust the V_{GS} voltages to the values in Figure 6 by using the RG potentiometer,
11. Adjust the V_{DS} voltages to the values in Figure 6 by using Adjustable DC Power Supply,
12. Record I_D values that correspond to V_{GS} and V_{DS} voltages, and fill in the table,
13. Turn the power off for Y-0016 Training Set.
14. Sketch the V_{GS} and the I_D values into Figure 7.

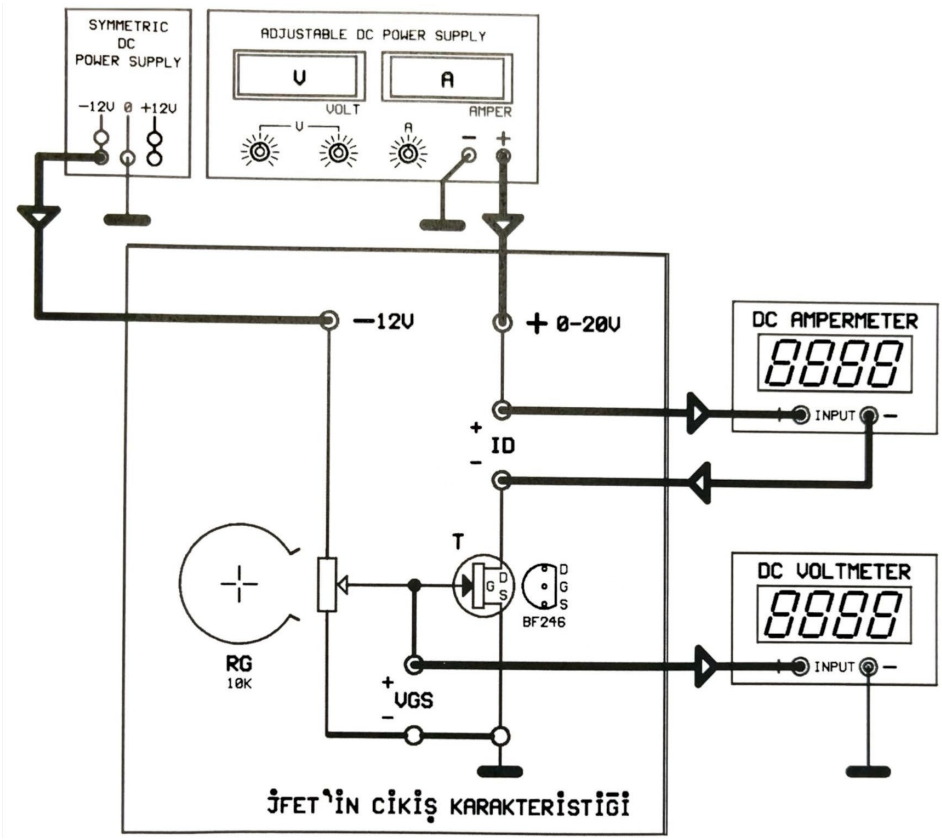

Figure 4: Connection scheme of JFET output characteristic circuit.

During the experiment, JFET increases its resistance by increasing the drain current. As a result, the drain current begins to decrease. The resulting heat can also damage the JFET. Therefore, values should be taken as quickly as possible in measurement steps!

Results:

Input Characteristics of JFET

V_{DS} = 12V (Constant)	
V_{GS} (Volt)	I_D(mA)
0.0	
-0.5	
-1.0	
-1.5	
-2.0	
-2.5	
-3.0	
-3.5	
-4.0	

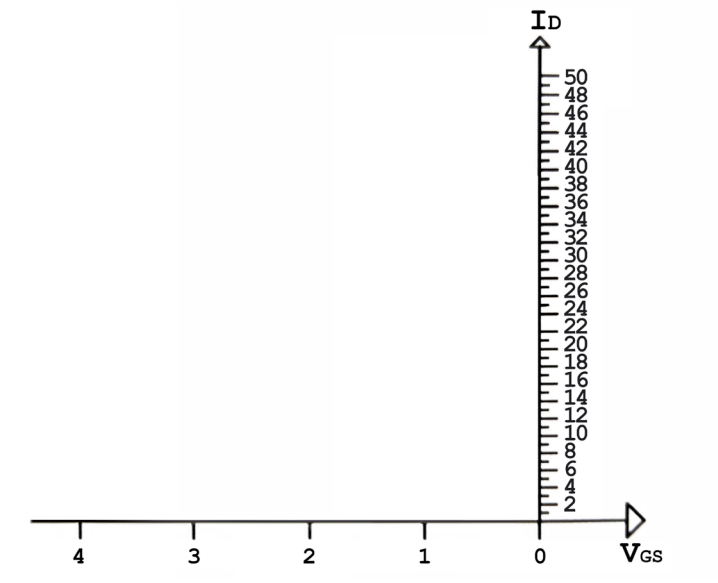

Figure 5: Input characteristic curve according to V_{GS} and I_D

Output Characteristics of JFET

$V_{GS} = 0V$ (Constant)		$V_{GS} = -1V$ (Constant)		$V_{GS} = -2V$ (Constant)		$V_{GS} = -3V$ (Constant)		$V_{GS} = -4V$ (Constant)	
V_{DS} (Volt)	I_D (mA)	V_{DS} (Volt)	I_D (mA)	V_{DS} (Volt)	I_D (mA)	V_{DS} (Volt)	I_D (mA)	V_{DS} (Volt)	I_D (mA)
1		1		1		1		1	
2		2		2		2		2	
3		3		3		3		3	
4		4		4		4		4	
5		5		5		5		5	
10		10		10		10		10	
15		15		15		15		15	
20		20		20		20		20	

Figure 6: I_D current values with respect to V_{DS} voltages at constant V_{GS} voltage

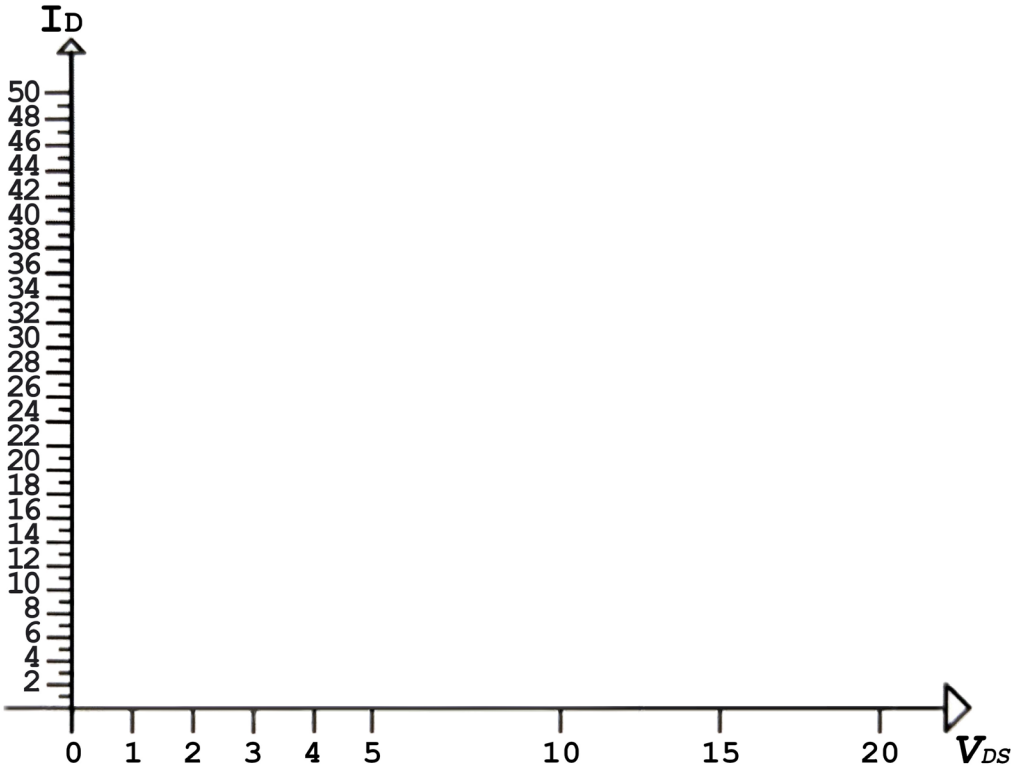

Figure 7: Output characteristic curve according to V_{DS} and I_D

Conclusion: