AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING (EEE)

EXPERIMENT NO.	**:**	**09**
NAME OF THE EXPERIMENT	**:**	**STUDY OF MOSFET COMMON SOURCE (CS) SMALL SIGNAL AMPLIFIER.**
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ID	**:**	**22-46013-1**
COURSE TITLE	**:**	**ELECTRONIC DEVICES LABORATORY**
SECTION	**:**	**Q**
GROUP NO.	**:**	**05**
DATE OF PERFORMANCE	**:**	**APRIL 04, 2023**
DATE OF SUBMISSION	**:**	**APRIL 14, 2023**

Objective of the Experiment:

The objective at this experiment is to study the characteristics of MOSFET common source (cs) amplifier and become familiar with it. It aims to determine the voltage gain, input and output voltages using DC and AC analysis, as well as the input and output waveforms of the cs amplifier circuit.

List of Components:

1. Trainer Board.
2. Multimeter.
3. DC power supply. ($V_{cc} = +10V$)
4. Function Generator. (Frequency = 10KHz)
5. Resistor (5.6 kΩ, 10kΩ, 100kΩ, 1MΩ)
6. MOSFET: n-channel MOSFET (IRF540)
7. Capacitor. (22uF, 22uF)
8. Oscilloscope
9. Connecting wire.
10. Power Cable and Probes.

Diagram:

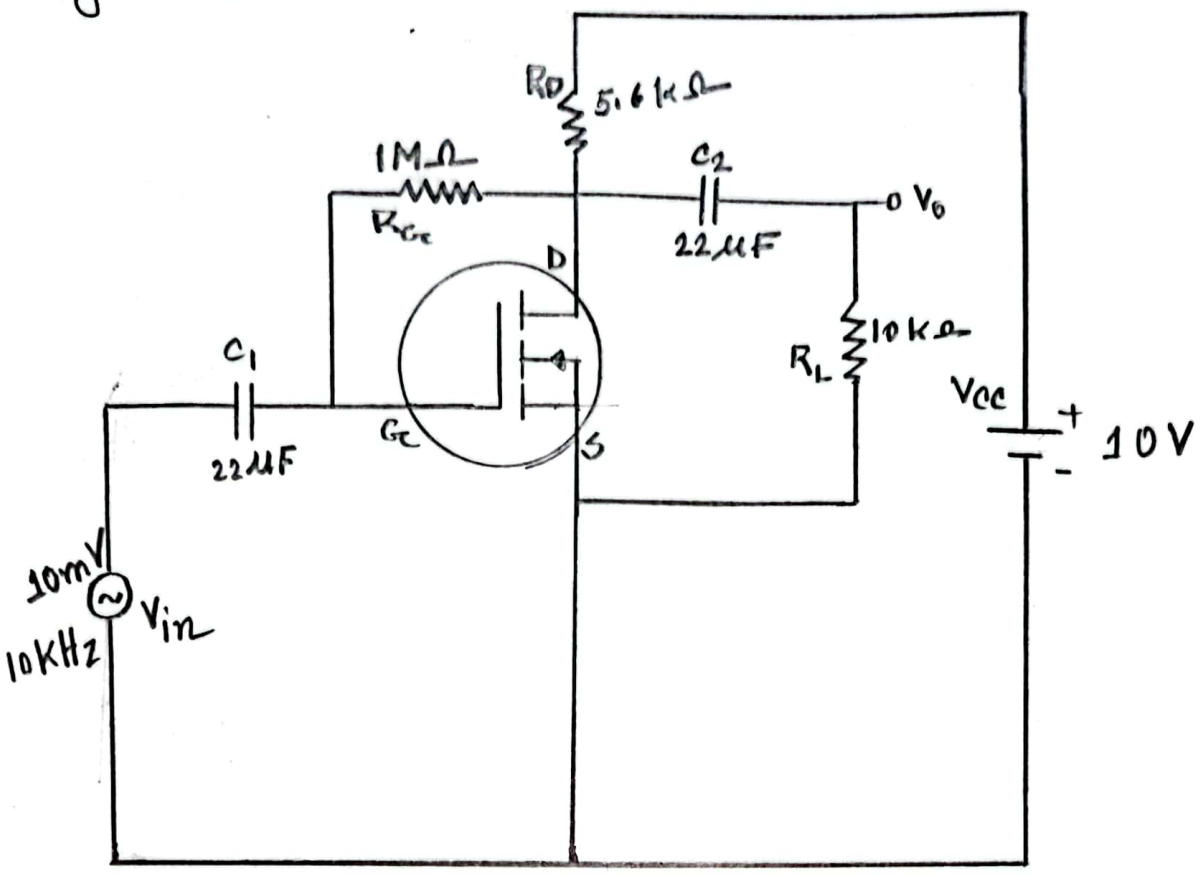

Figure 1: n-channel MOSFET common source Amplifier.

Working Principle of the Circuit

The n-channel MOSFET common source (CS) amplifier circuit is a type of amplifier circuit that an n-channel MOSFET as the amplifying device.

The circuit is first biased by applying a DC voltage to the gate of the MOSFET transistor. This voltage should be large enough to ensure that the transistor remains in its active region, but not too large that it drives the transistor into saturation.

An AC signal is then applied to the input of the circuit, which is coupled to the gate of the MOSFET transistor

The modulated drain current flows through the load resistor, causing a voltage drop across it. This voltage drop is the output signal of the amplifier circuit, which is larger in magnitude than the input signal due to the voltage gain of the circuit.

The output signal is the coupled to the load or the next stage of the amplifier circuit using a coupling capacitor. This capacitorblocks the DC bias voltage from the output signal, allowing only the AC signal to pass through.

Data and Calculation:

Table 1: DC Analysis

V_{cc} (V)	V_D	V_S (V)	V_{GS} (V)	I_D (mA)
10	8.71	0	2.30	0.233

Table 2: AC Analysis.

Frequency (KHz)	V_{in} (mV)	Max V_{in} (mV)	V_o	A_V	Phase Diff.
10	107	147.72	284	2.654	36°

Waveforms:

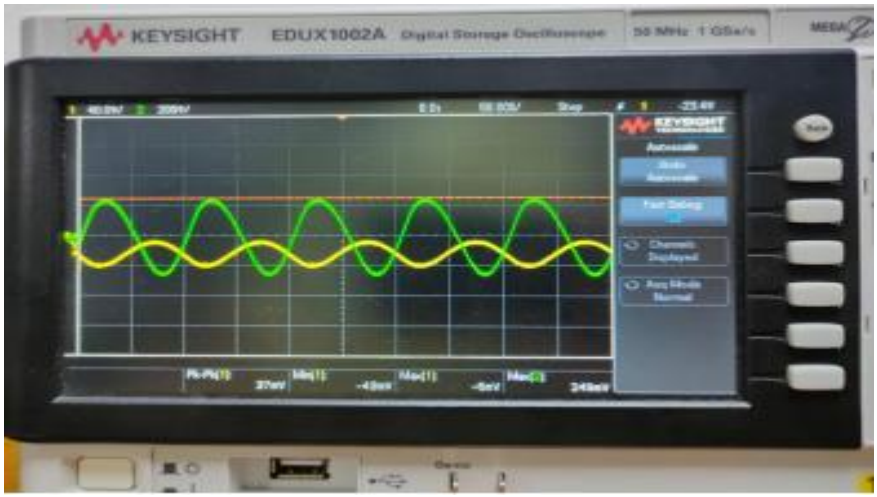

Figure 2: Input and Output Signals of the MOSFET Common Source (CS) Small Signal Amplifier.

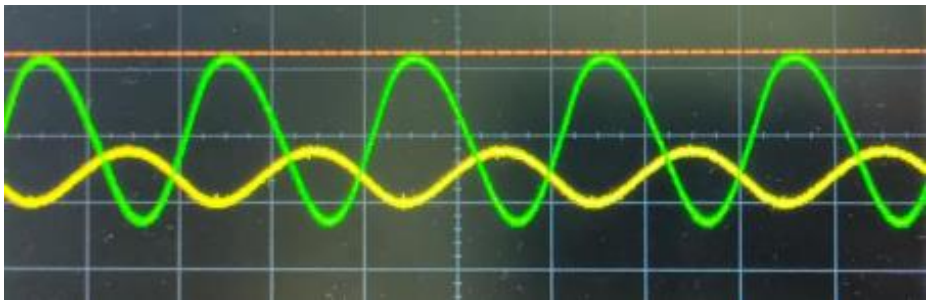

Figure 3: Undistorted input and output signal.

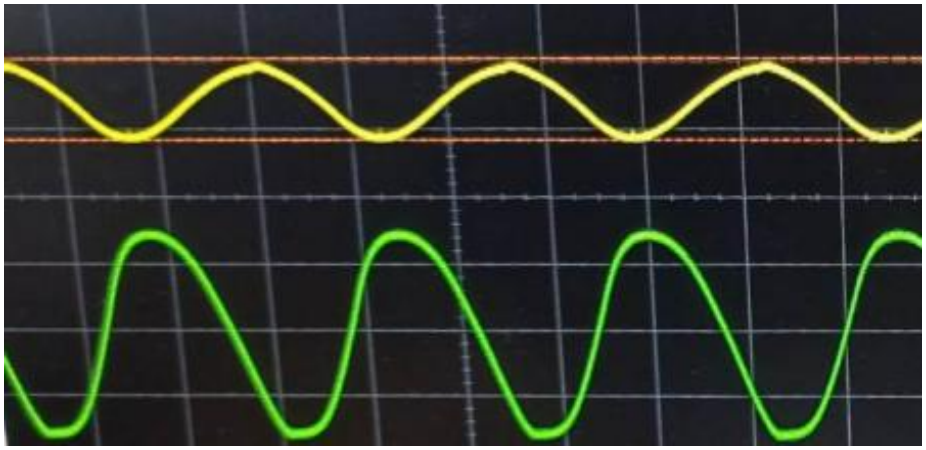

Figure 4: Distorted input and output signal

Discussion:

In this experiment, we learned about the common source (CS) MOSFET small signal amplifier: according to figure: 1 circuit. The accuracy of the analysis depended on careful implementation with precise biasing and avoiding supply voltage exceeding the breakdown voltage. Proper biasing was critical to obtaining expected result. Upon applying the input signal and gradually increasing its amplitude, the output clipping was noted, and the measured were recorded. Calculation of voltage gain showed that the output voltage was being amplified.

Most of our theoretical resemble the experimental values expect in a few cases. This difference could be explained by experimental errors during performing the lab. This error could be associated with the circuit which are the low dynamic range Imposed by the small signal limit.

We can solve this or reduce the rate by taking all values carefully and measured multiple time while reening the experiment

Conclusion:

During the experiment, it was noted that the output voltage ~~sig~~ exceeded the input voltage significantly. The result was also replicated during the lab performance. It was edited that the MOSFET was amplifying the input voltage. To obtain an amplified signal that was not distorted, the voltage was calibrated, and the optimized voltage was applied to the circuit. the experiment was conducted with precision, and the outcome mathed the known characteristic of the MOSFET, thereby achiving the goal of the experiment

Remarks:

The study of MOSFET common source (CS) small signal amplifier is a fundamental eaperiment for us. By conducting we achived our all goals as we mentioned in the objectives. Overall, this expeiment was valuable learning for us.

List of References:

[1] A.S. sedra, K.C. Smith, Microelectronic Circuits. Oxford university press (1998)

[2] American International University-Bangladesh (AIUB) Electronic Device lab Mannual.

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Table-1 (DC Analysis)

V_{CC}(V)	V_D(V)	V_S(V)	V_G(V)	I_D(mA)
10 V	8.71	0	2.30	0.233

Table-2 (AC Analysis)

Frequency	V_{IN} rms	Max Vin	V_O rms	Av	Phase Difference
10 KHz	107 mV	147.72 mV	284 mV	2.654	36