Examination of MOS transistor

Tasks:

I.Practical measurements:

1. Measure the output characteristic of MOS transistor $I_D = f(U_{DS})$ for $U_{GS} = \text{const.}$
2. Measure the transfer characteristic of MOS transistor $I_D = f(U_{GS})$ for $U_{DS} = \text{const.}$

II. Graphics:

1. Draw the V-A output characteristics of MOS transistor.
2. Draw the V-A transfer characteristics of MOS transistor.

III. Calculations:

1. From the output characteristic calculate the output resistance

   $R_{DS} = dU_{DS} / dI_D \approx \Delta U_{DS} / \Delta I_D$, for $U_{GS} = \text{const.}$

2. From the transfer characteristic calculate the transconductance

   $S = dI_D / dU_{GS} \approx \Delta I_D / \Delta U_{GS}$, for $U_{DS} = \text{const.}$

Answer the questions

1. What are the operation regions in the output characteristics? Define the conditions for working in these regions. What is the equation for U_{Dsat} in connection with gate-source voltage U_{GS} and threshold voltage U_T?
2. What is the definition of threshold voltage for the enhancement-mode MOSFET? What is the value of threshold voltage U_T for measured MOSFET?
3. What is the polarity of threshold voltage for enhancement-mode MOSFET? Explain why it has such polarity taking in consideration principle of operation of this transistor?

4. **Output Characteristic:**

Table 1

U_{DS}, V		0	2	4	6	8	10	12	14	16	18	20
I_D, mA	U_{GS}=4V											
	U_{GS}=5V											
	U_{GS}=6V											
	U_{GS}=7V											
	U_{GS}=8V											
	U_{GS}=9V											

Transfer Characteristic:

Table 2

U_{GS}, V		0	2	2,5	3	3,5	4	5	6	7	8	9	10
I_D, mA	U_{DS}=1V												
	U_{DS}=2V												
	U_{DS}=5V												
	U_{DS}=10V												