EE_HW1

● Graded

Student

苏慧哲

Total Points

93 / 100 pts

Question 1

Electrical and electronic technology **25** / 25 pts

1.1 **(no title)** **10** / 10 pts

✔ **– 0 pts** Correct

1.2 **(no title)** **5** / 5 pts

✔ **– 0 pts** Correct

1.3 **(no title)** **10** / 10 pts

✔ **– 0 pts** Correct

Question 2

Linear resistive network **29** / 30 pts

2.1 **(no title)** **5** / 5 pts

✔ **– 0 pts** Correct

– 2 pts lack of schematic

– 3 pts lack figure of I-V characteristics

– 2 pts the schematic is wrong.

– 3 pts The figure of I-V is wrong.

– 1.5 pts The I-V charateristics of current source is wrong

– 1 pt lack of shcematic of current source.

– 1.5 pts lack I-V characteristics of current source.

– 1.5 pts the figure of current source is wrong

– 1.5 pts lack I-V characteristics of voltage source.

– 1 pt lack of shcematic of voltage source.

– 1 pt Please draw I-V figure

2.2 **(no title)** Resolved **14** / 15 pts

– **0 pts** Correct

– **5 pts** lack of waveform or waveform is wrong

✔ – **1 pt** schematic without ground (1)

– **10 pts** lack of schematic or schematic is wrong

– **6 pts** lack of waveform (1) or waveform is wrong.

– **14 pts** schematic is wrong.

– **1 pt** lack result of i1

– **2 pts** the result of i1 is wrong.

– **3 pts** The schematic has a slight error.

– **1 pt** Wrong direction of current

Regrade Request **Submitted on:** Nov 24

2.2， 图应该是没有问题的，因为图中的电压是2v稳定电压，然后电流到电压的转换比是1:1，请注意我没有使用默认的电流电压转换比。

首先，图不是没有问题的，这道题的正确答案应该是电流的波形，很显然你是将电流转化为电压，最后显示出的图像是为电压图像，很明显在示波器中看到的单位是V，纵轴是幅值，横轴是时间，所以这依旧是一个电压-时间图。并且只有波形对是不行的，各个参数的度量也必须要对应上。
但是，后来发现同学们没几个人做对，所以后来改了评分标准，只要是有关于i1的图像我都给分了。之所以给你扣了是因为我在重判的时候没改过来，这是我的问题。

Reviewed on: Nov 24

2.3 **(no title)** **5** / 5 pts

✔ – **0 pts** Correct

– **5 pts** Wrong

– **1 pt** Wrong direction of current

– **3 pts** Lack of subcircuit calculation results.

2.4 **(no title)** **5** / 5 pts

✔ **– 0 pts** Correct

– 5 pts Wrong

– 3 pts lack of reason

– 3 pts reason is wrong

– 1 pt There's no analysis of 3A

– 1 pt There's no analysis of 4A

– 1 pt There's no analysis of 25V

Question 3

Diode circuits **16** / 20 pts

3.1 **(no title)** **15** / 15 pts

✔ **– 0 pts** Correct

– 10 pts No schematic

– 15 pts schematic and answers are wrong

– 5 pts The current value is missing

– 5 pts Current probe position is wrong

– 10 pts Schematic and answers are wrong

– 5 pts The voltage value is missing

– 10 pts No answers

– 5 pts Current value is wrong

3.2 **(no title)** **1** / 5 pts

– 0 pts Correct

– 5 pts Wrong answer

✔ **– 4 pts** wrong reasons

Question 4

Transistor characteristics **23** / 25 pts

4.1 **(no title)** **20** / 20 pts

✔ **– 0 pts** Correct

– 10 pts Wrong curves

– 10 pts No schematic

– 10 pts Wrong schematic

– 5 pts please try more Vgs

– 10 pts no curve

4.2 **(no title)** **Resolved** **3** / 5 pts

– 0 pts Correct

– 5 pts Click here to replace this description.

✔ **– 2 pts** Click here to replace this description.

Regrade Request **Submitted on:** Nov 24

4.2， on的解释可能有问题，因为我以为on是指通过电流达到饱和区，但off的解释应该是没有问题的，根据题目中给的图来看v_to指的是阈值电压。

抱歉，我误判了，分数加上去

Reviewed on: Nov 24

Questions assigned to the following page: 1.1 and 1.2

Problem Set #1, EE part

Issue date: Nov. 6, 2020; Deadline: 23:59, Nov. 13, 2020

Student Name: _____苏慧哲_____ Student No.: ____2020533009_____

1. Electrical and electronic technology

As introduced during the first lecture, many milestone technologies enable electrification (电气化) and informatization (信息化) during the second and third industrial revolutions. In this problem, you are asked to search the Internet (google, bing, baidu, etc.), and find out the specific details of these two concepts.

- Can you specify the different features of electrification and informatization? (10')

Electrification is the process to replace earlier power source for electricity, which happened on a large scale during the Second Industrial Revolution. Informatization is the process to merge information technologies such as digital electronics, computers, and internet with the existing production or daily life, which mostly happened after the Digital Revolution (or the Third Industrial Revolution).

REFERENCE:

Electrification is the process of powering by electricity and, in many contexts, the introduction of such power by changing over from an earlier power source.

(Wikipedia – Electrification: https://en.wikipedia.org/wiki/Electrification*)*

While the First Revolution was marked by the introduction of such concepts as interchangeable parts and mass production, and was largely water-powered (especially in the United States), the Second was characterized by the build out of railroads, large-scale iron and steel production, widespread use of machinery in manufacturing, greatly increased use of steam power, widespread use of the telegraph, use of petroleum and the beginning of electrification.

(Wikipedia – Second Industrial Revolution: https://en.wikipedia.org/wiki/Second_Industrial_Revolution*)*

G. Wang describes the same phenomenon (1994) which she calls "informatization" as a "process" of change that features (a) the use of informatization and IT (information technologies) to such an extent that they become the dominant forces in commanding economic, political, social and cultural development; and (b) unprecedented growth in the speed, quantity, and popularity of information production and distribution."

(Wikipedia – Informatization: https://en.wikipedia.org/wiki/Informatization*)*

The Digital Revolution (also known as the Third Industrial Revolution) is the shift from mechanical and analogue electronic technology to digital electronics which began in the latter half of the 20th century, with the adoption and proliferation of digital computers and digital record-keeping, that continues to the present day.

(Wikipedia – Digital Revolution: https://en.wikipedia.org/wiki/Digital_Revolution*)*

- Besides the winners of the five Nobel Prize winner, tell us another one pioneering scientist or engineer who has made significant contributions towards electrification or informatization. (5')

Michael Faraday, an English scientist, discovered Faraday's law and built the first electromagnetic generator, which are significant contributions towards electrification.

REFERENCE:

In the years 1831–1832, Michael Faraday discovered the operating principle of electromagnetic generators. The principle, later called Faraday's law, is that an electromotive force is generated in an electrical conductor that is

Questions assigned to the following page: 2.1, 1.2, and 1.3

subjected to a varying magnetic flux, as for example, a wire moving through a magnetic field. He also built the first electromagnetic generator, called the Faraday disk, a type of homopolar generator, using a copper disc rotating between the poles of a horseshoe magnet. It produced a small DC voltage.
(Wikipedia – Electrification:
https://en.wikipedia.org/wiki/Electrification#Development_of_magnetos,_dynamos_and_generators*)*

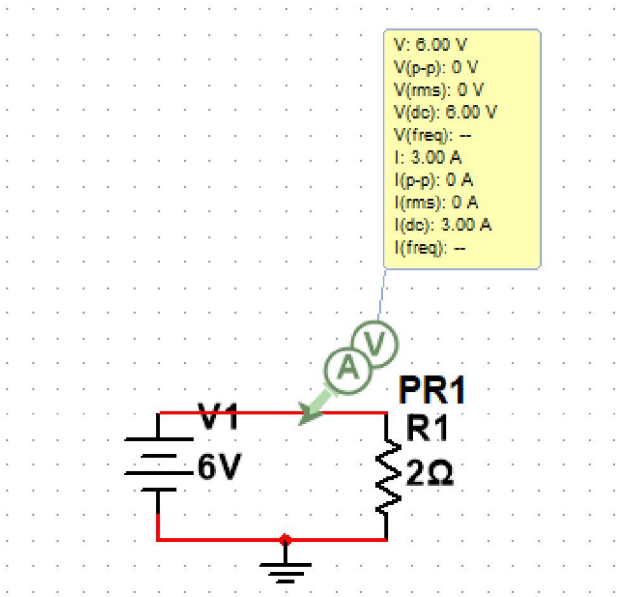
- Point out one of his/her most representative discoveries or inventions. Briefly explain the working principle of such discovery or invention and its relation to electrical engineering (10')

Faraday's law presents the fact that a changing magnetic field produces an electric field, which had laid a foundation for the invention of the electromagnetic generator. With the help of the law, the kinetic energy can then be converted into electricity, which makes electrification possible.

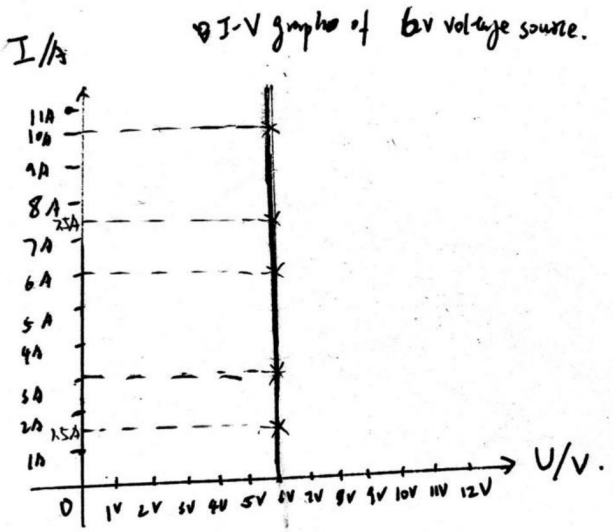
REFERENCE:
In subsequent experiments, he found that if he moved a magnet through a loop of wire an electric current flowed in that wire. The current also flowed if the loop was moved over a stationary magnet. His demonstrations established that a changing magnetic field produces an electric field; this relation was modelled mathematically by James Clerk Maxwell as Faraday's law, which subsequently became one of the four Maxwell equations, and which have in turn evolved into the generalization known today as field theory.
(Wikipedia – Michael Faraday: https://en.wikipedia.org/wiki/Michael_Faraday#Electricity_and_magnetism*)*

2. Linear resistive network

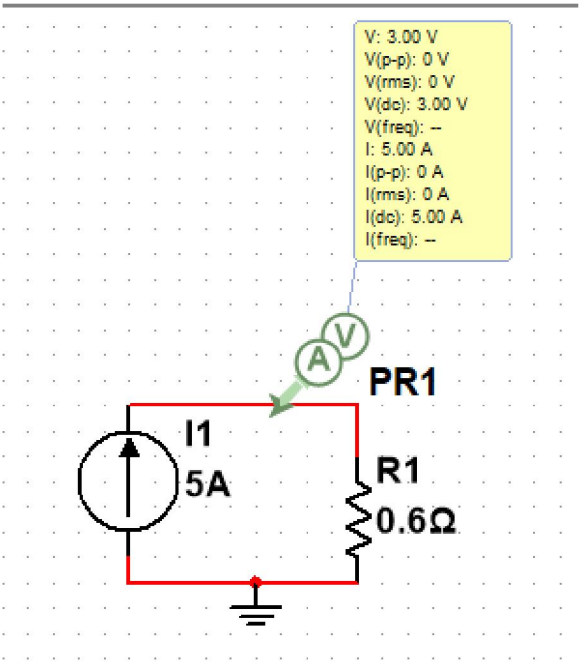
- Use Multisim simulation to study the I-V characteristics of a current source and a voltage source (hint: connect a resistor and change its value, mark down the current and voltage history). (5')



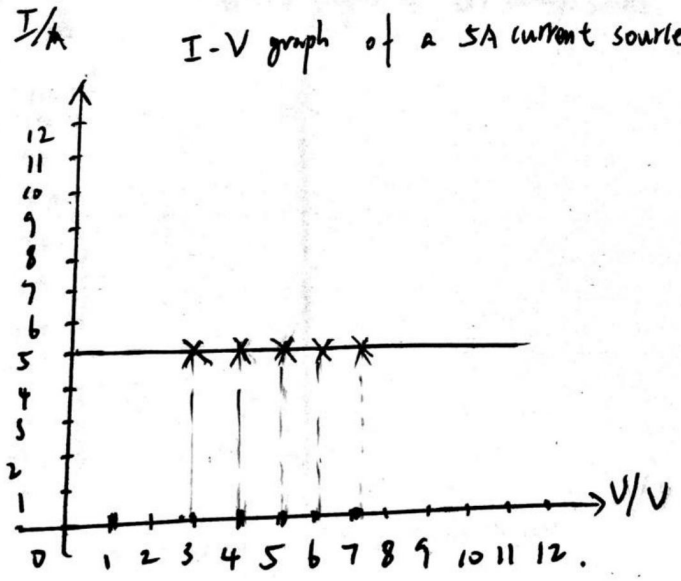
Question assigned to the following page: 2.1



No	U/V	I/A	R/Ω
1	6	6	1
2	6	3	2
3	6	1.5	4
4	6	7.5	0.8
5	6	10	0.6



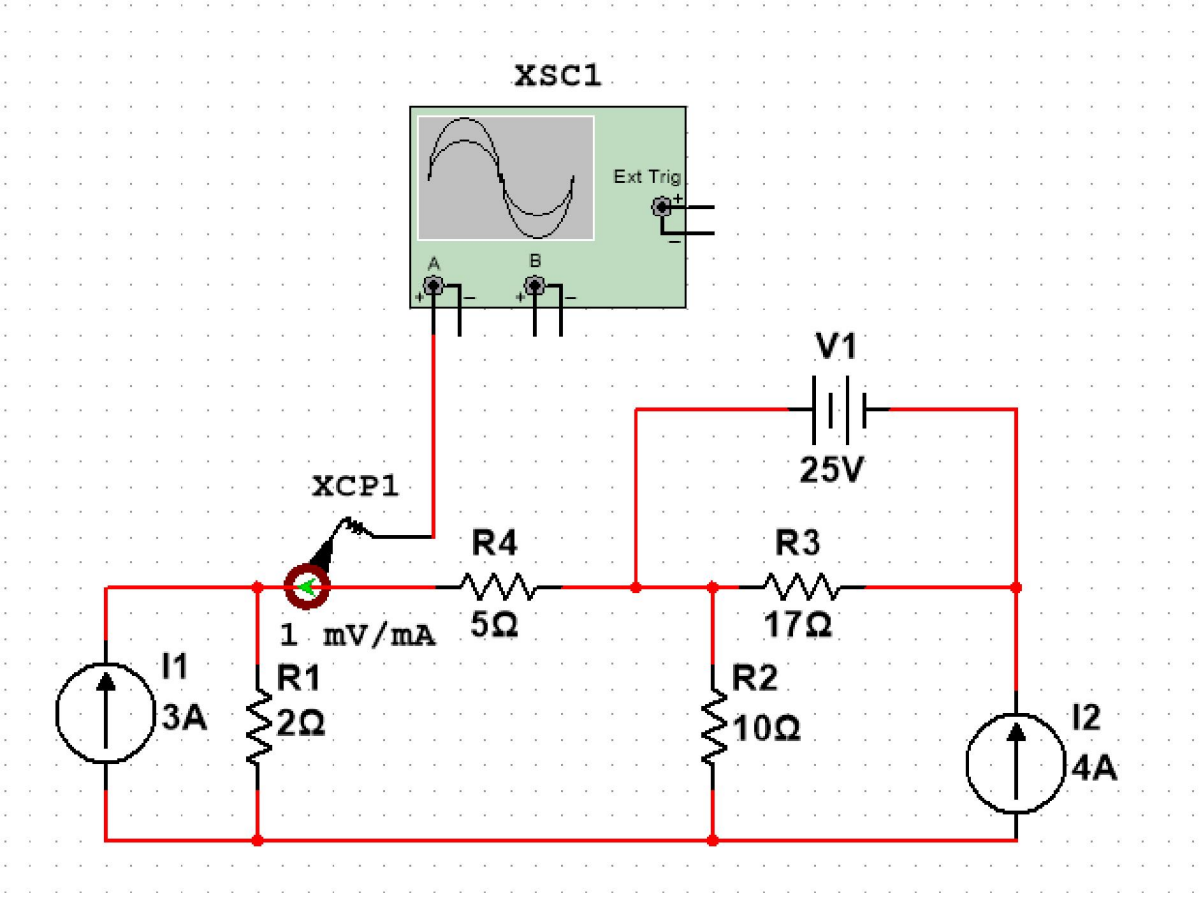
Questions assigned to the following page: 2.1 and 2.2

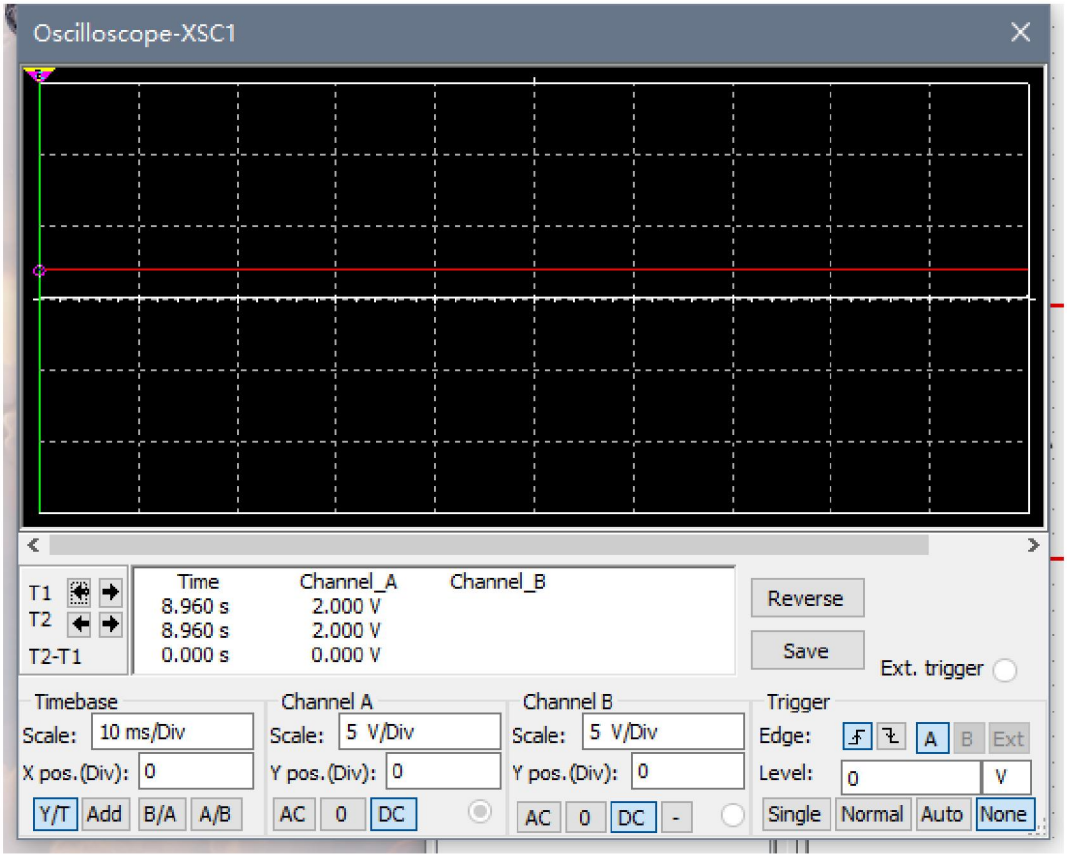


ID	V/V	I/A	R/Ω
1	3.	5	0.6
2	4	5	0.8
3	5	5	1
4	6	5	1.2
5	7	5	1.4

- Determine the value of i_1 in the following circuit using
  - Multisim simulation tool (show the circuit schematic, simulation waveform). (15')

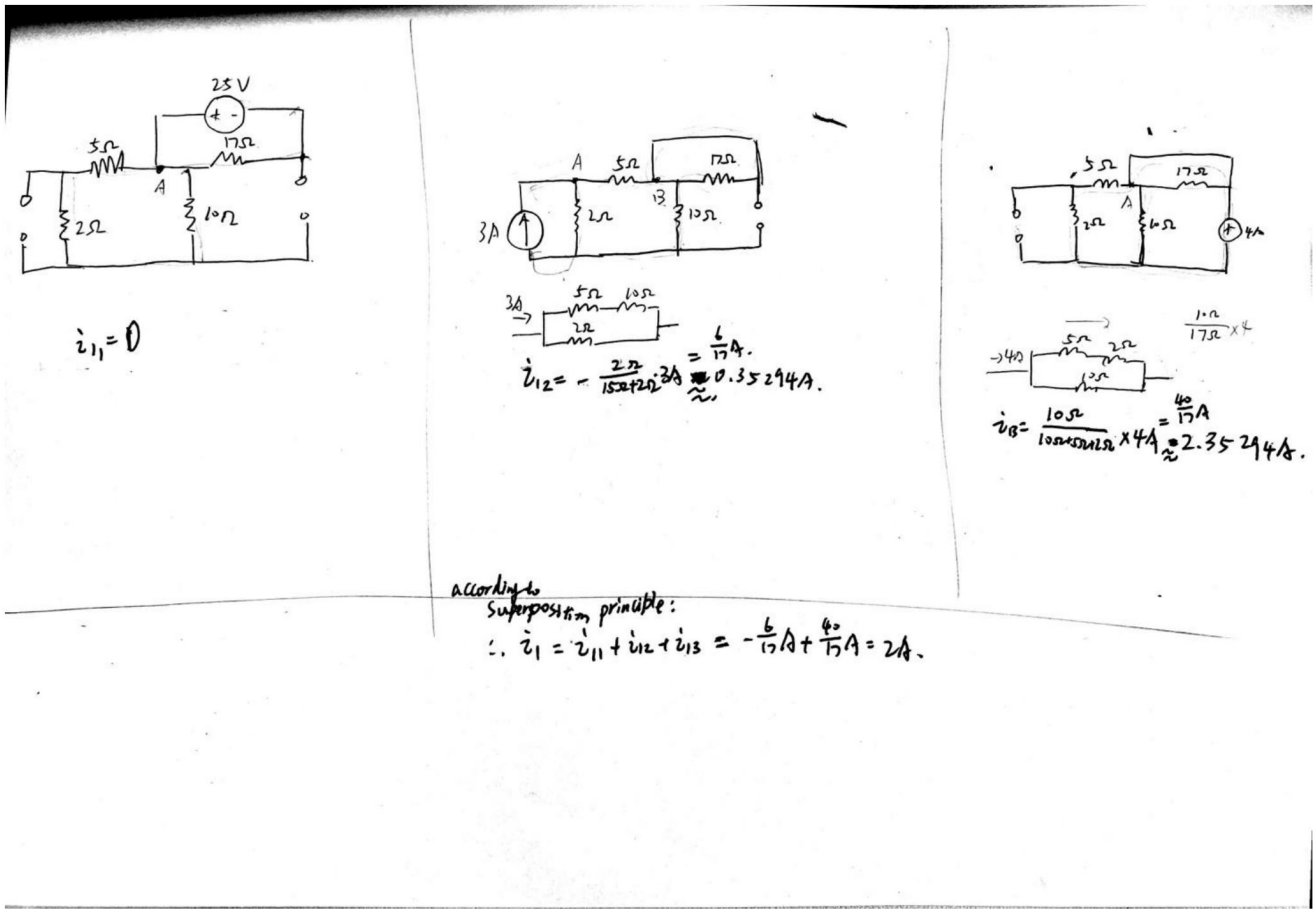
Question assigned to the following page: 2.2


XSC1
Ext Trig
A
B
V1
25V
XCP1
R4
5Ω
R3
17Ω
1 mV/mA
I1
3A
R1
2Ω
R2
10Ω
I2
4A


Oscilloscope-XSC1
T1
T2
T2-T1
Time
Channel_A
Channel_B
8.960 s
2.000 V
8.960 s
2.000 V
0.000 s
0.000 V
Reverse
Save
Ext. trigger
Timebase
Scale: 10 ms/Div
X pos.(Div): 0
Y/T Add B/A A/B
Channel A
Scale: 5 V/Div
Y pos.(Div): 0
AC 0 DC
Channel B
Scale: 5 V/Div
Y pos.(Div): 0
AC 0 DC
Trigger
Edge: A B Ext
Level: 0 V
Single Normal Auto None

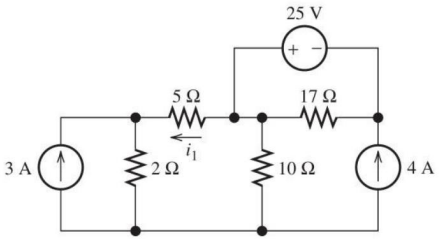
Questions assigned to the following page: 2.3 and 2.4

- Superposition principle 叠加原理. Search the Internet for more information about superposition in circuit analysis. (5')



- What effect does the 17-Ω resistance have on the answer? Explain. (5')

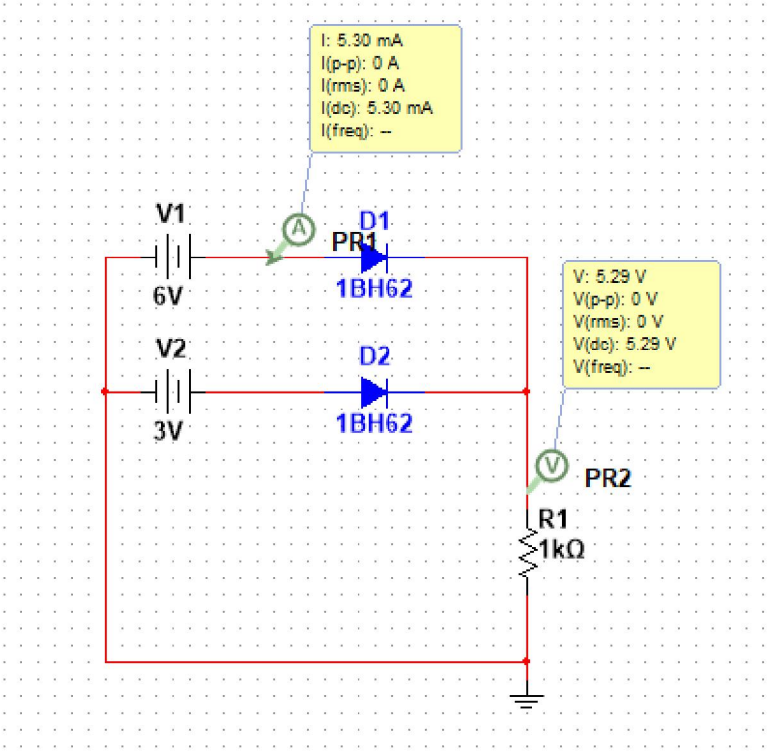
It doesn't affect the answer. As is depicted in the previous graph, when calculating both current sources, the 17-Ω resistance has been short-circuited, so it has no effect. When calculating the 25 V source, 5-Ω resistance, 2-Ω resistance and 10-Ω resistance are all cut off, so the current through 5-Ω resistance is 0. It doesn't affect the i_1, since i_1 is 0 all the time. Because it doesn't affect the i_1 in all three conditions, and answer obtained by superposition principle is simply add up the i_1 in all condition, so it doesn't affect the answer.



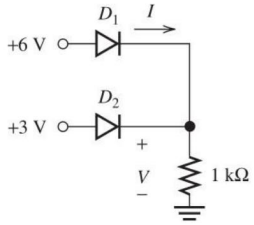
Questions assigned to the following page: 3.1 and 3.2

3. Diode circuits

- Find the values of I and V for the circuits of the following figures using Multisim. (15')



- Which diode is conducted? Why? Can you further explain the working principle of this circuit? (5')

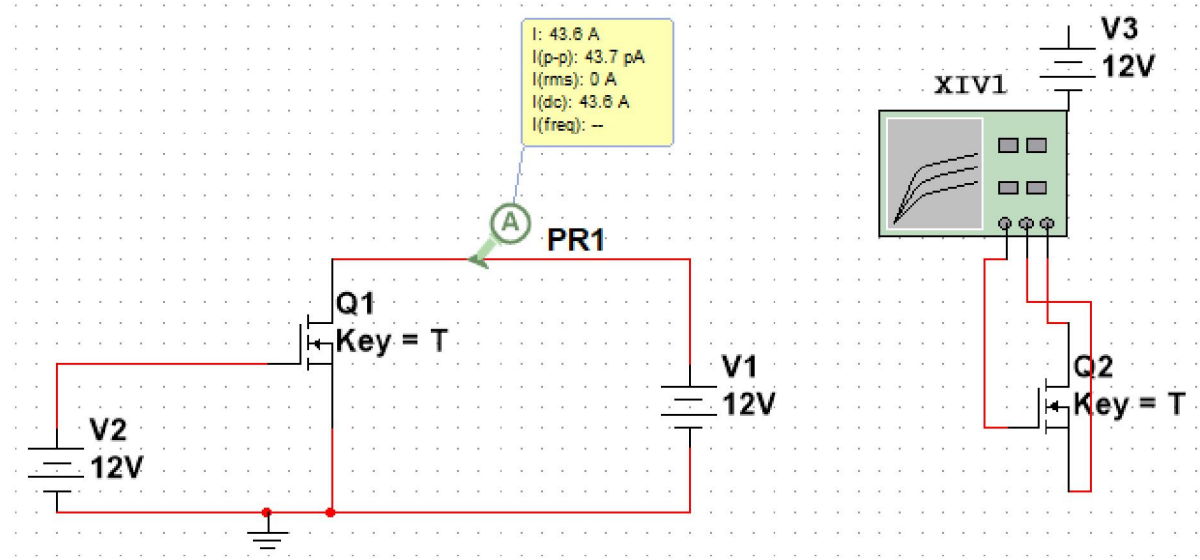


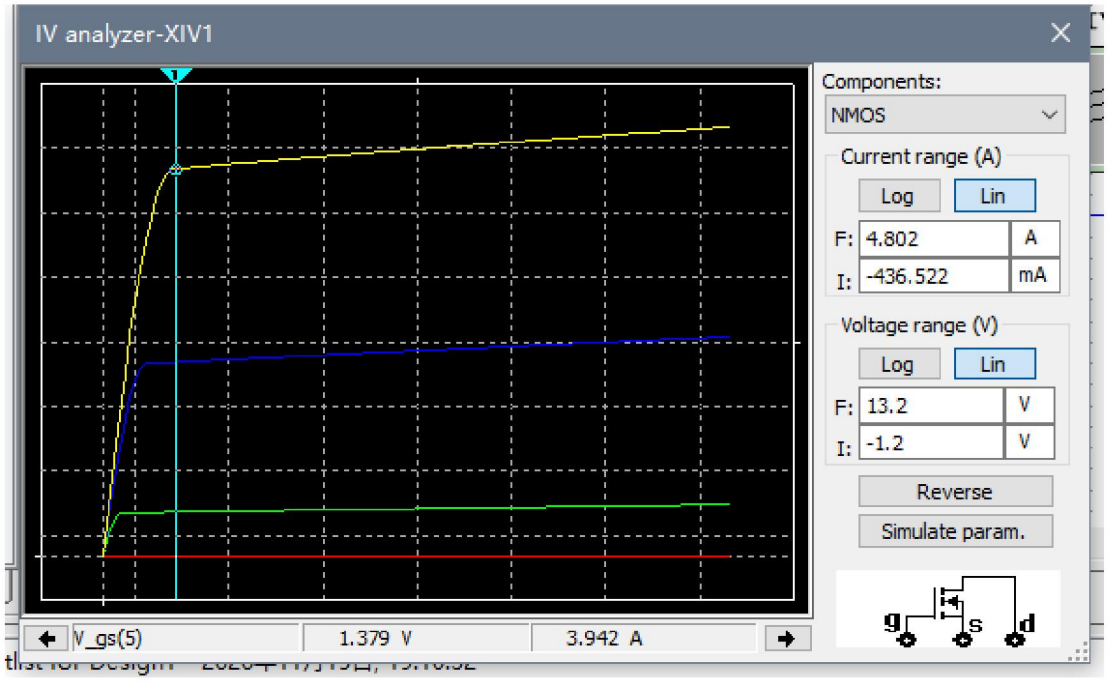
D_1 is conducted. Because when there're no diode, according to superposition principle, the current is from D_1 to D_2. When there're diode, the current can only flow from the left to the right, so the current of D_2 is blocked, and thus D_2 is not conducted but D_1 is conducted.

4. Transistor characteristics.

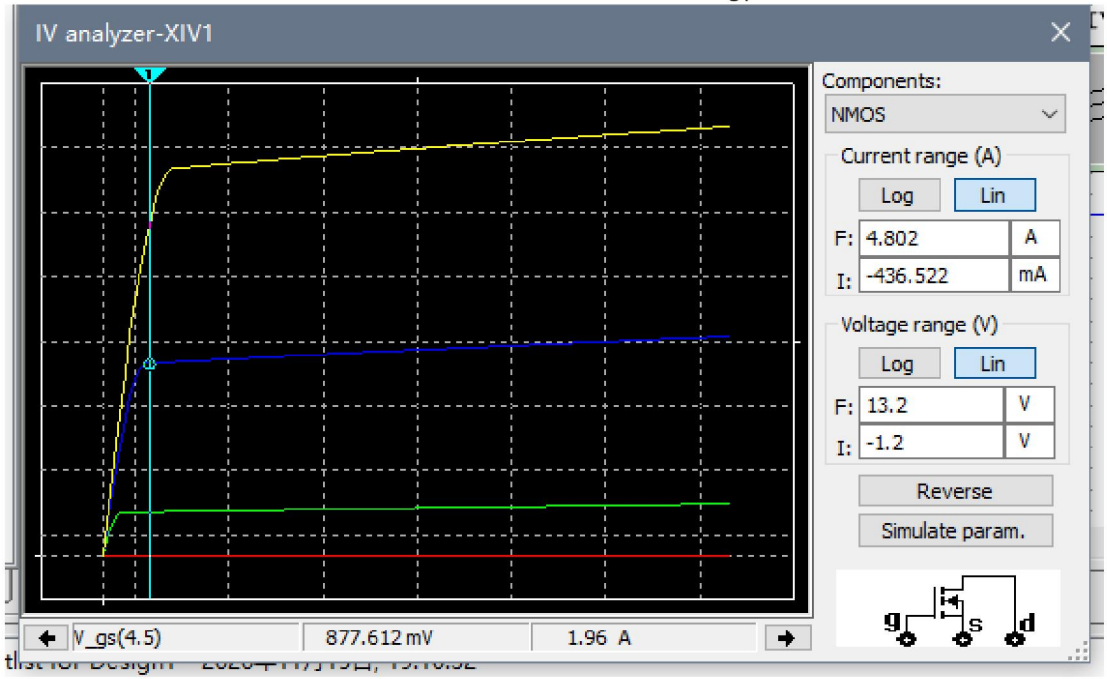
- Select an NMOS model in Multisim. Build a simple single-MOSFET circuit, as shown below. Generate the characteristic curves under different v_{GS} (as Figure 12.6 did in the EE textbook). (20')

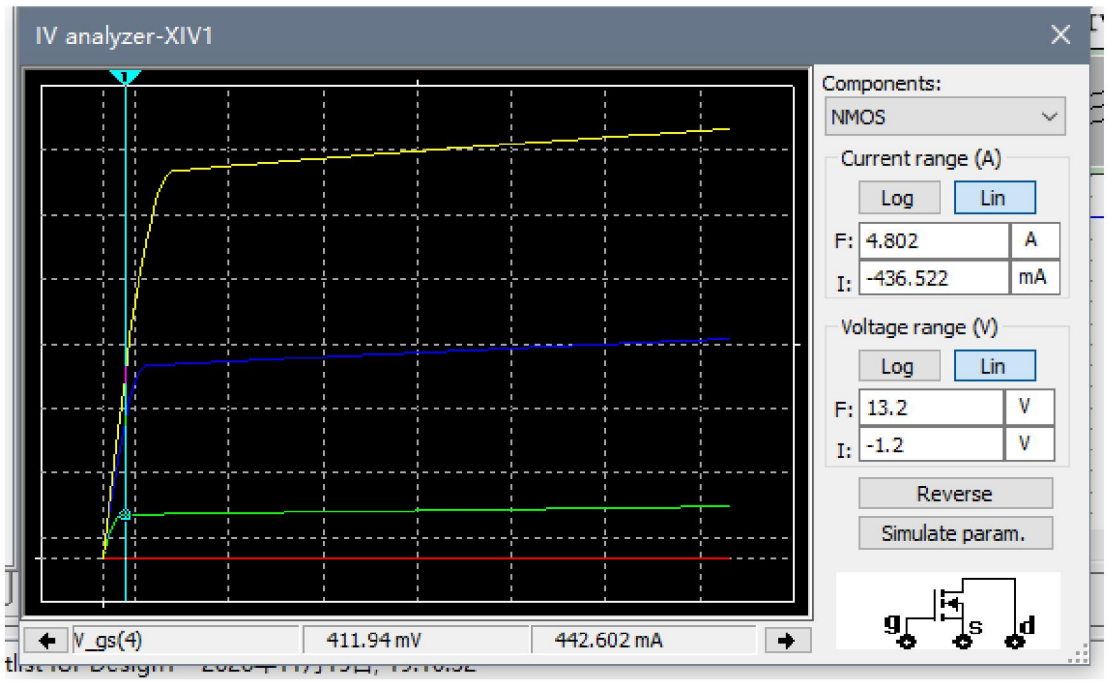
Question assigned to the following page: 4.1


I: 43.6 A
I(p-p): 43.7 pA
I(rms): 0 A
I(dc): 43.6 A
I(freq): --
A
PR1
Q1
Key = T
V1
12V
V2
12V
XIV1
V3
12V
Q2
Key = T


IV analyzer-XIV1
Components:
NMOS
Current range (A)
Log
Lin
F: 4.802 A
I: -436.522 mA
Voltage range (V)
Log
Lin
F: 13.2 V
I: -1.2 V
Reverse
Simulate param.
V_gs(5)
1.379 V
3.942 A
g
s
d

Questions assigned to the following page: 4.1 and 4.2

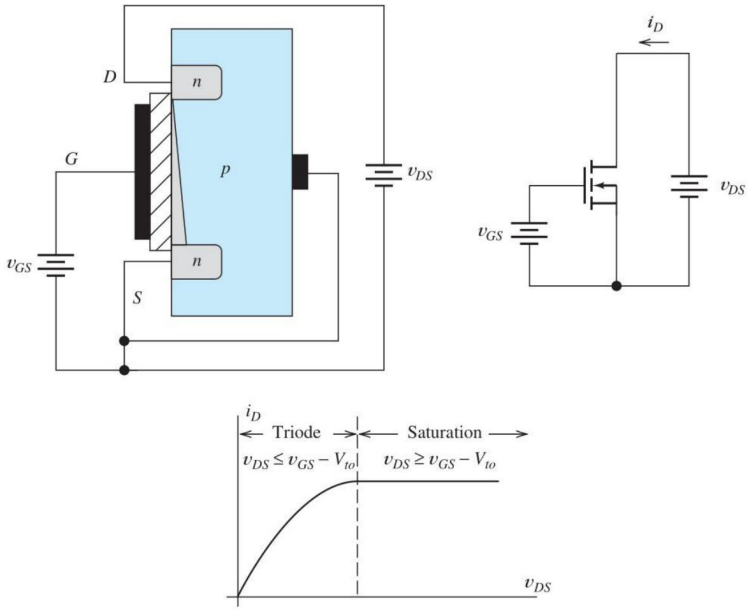




- How to make it “on” or “off”? (5’)
  ‘On’ means that the transistor is in saturation region, which means that $V_{DS} \geq V_{GS}$ - Vto.

Question assigned to the following page: 4.2

'Off' means that no current pass through the transistor. In this case, neither $V_{DS} = 0$ or $V_{GS} < V_{to}$.



** Please submit the softcopy of your solutions to the problems on gradescope.*

** All flow charts and codes should be enclosed in your solutions.*

** Discussion on methodology is allowed, yet, the assignment should be done individually. Plagiarism, once found, grades zero for the whole homework assignment!!*