

## **СЕКЦИЯ 6. Полупроводниковая микро- и наноэлектроника в решении проблем информационных технологий и автоматизации**

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2. Avset B.S. The effect of metal field plates on multiguard structures with floating  $p^+$  guard rings / B.S. Avset, L. Evensen // Nuclear Instruments and Methods in Physics Research. 1996. Vol. 377. P. 397-403.

3. Проектирование на ЭВМ ограничительных колец с учётом заряда в диэлектрике / С.А. Малеев и др. // Электронная техника. Полупроводниковые приборы. М.: 2007.

4. Theory and Breakdown Voltage for Planar Devices with a Single Field Limiting Ring / M.S. Adler, V.A.K. Temple, A.F. Ferro // IEEE Transactions on electron Devices, 1997. V. ED 24. № 2. P. 107-112.

### **STUDYING OHM AND KIRCHHOFF LAWS WITH THE HELP OF A LABORATORY STAND ON SOLAR CELLS**

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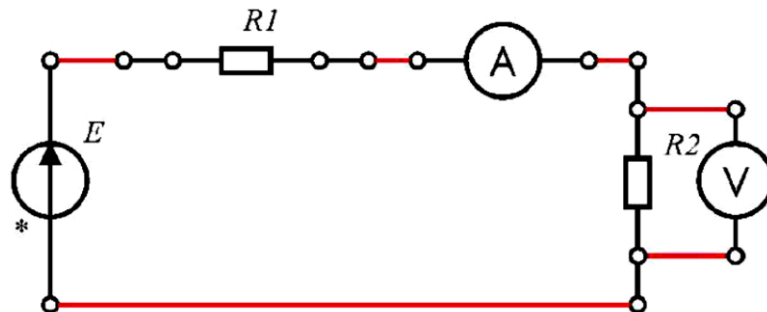
*TSTU named after Islam Karimov*

Demonstration physical experiments are shown in classes. To all types of sensory perception, it is necessary to add “work with hands” in the classroom. This is achieved when students perform a laboratory physical experiment, when they themselves assemble installations, measure physical quantities, and perform experiments. Laboratory studies arouse great interest among students, which is quite natural, since in this case the student learns about the world around him based on his own experience and his own feelings. The first group includes skills: to determine the purpose of the experiment, to put forward hypotheses, to select instruments, to plan an experiment, to calculate errors, to analyze results, to draw up a report on the work done. The second group includes skills: to assemble an experimental setup, to observe, measure, experiment. In this regard, laboratory benches are indispensable tools for understanding physical processes.

This topic is well provided with a variety of tasks, ranging from calculating the resistance of circuits to black box tasks. The laboratory stand for studying the laws of direct current includes 2 voltage sources on solar cells, an adjustable constant voltage source, an ammeter, a voltmeter, a set of fixed resistors, LED indicators and buttons. The elements are connected by wires with plug-in lugs. The current generated by solar cells under room lighting is enough to operate LEDs and test the laws of direct current. A regulated battery power supply is also provided which has a range of 0 to 10 volts. Charging is carried out from an external power source and has an operating time of about 50-100 hours. You can also use a digital tester to measure currents and voltages in a circuit.

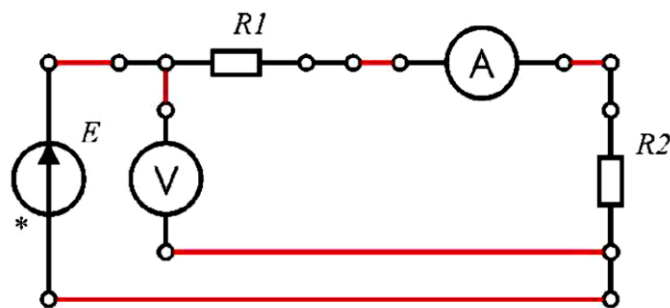
## СЕКЦИЯ 6. Полупроводниковая микро- и нанoeлектроника в решении проблем информационных технологий и автоматизации

To test Ohm's and Kirchhoff's laws, a laboratory stand for studying the laws of direct current (Pic. 1) is used, which includes 2 voltage sources on solar cells, an adjustable constant voltage source, an ammeter, a voltmeter, a set of fixed resistors, LED indicators and buttons.



Pic.1. Scheme for taking the current-voltage characteristics of a constant resistor

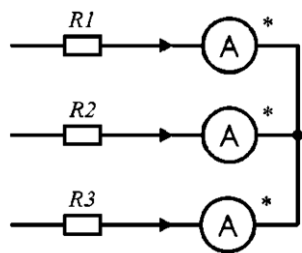
Ohm's law for a circuit section. For experimental verification of this law, it is possible to investigate the current-voltage characteristic of a constant resistor for linearity. To do this, you must use the scheme of Pic.1. Ohm's law for a complete circuit. For experimental verification of this law, one can compare the practical values of the current in a closed circuit with the theoretical value calculated by formula (3). To do this, you need to use the diagram in Pic.2.



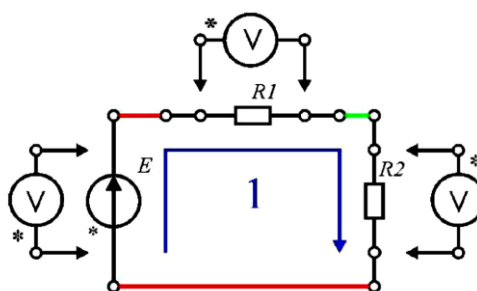
Pic.2. Circuit to test Ohm's law for a complete circuit

Kirchhoff's first law. To verify this law, you can assemble the circuit of Pic. 3. You can measure the values of currents in the branches by switching the ammeter to the corresponding branch. The ammeter should be turned on with the "\*" sign to the node.

Kirchhoff's second law. The polarity of the voltmeter must not be reversed with respect to the loop bypass direction. That is, the "\*" of the voltmeter should always indicate, for example, the base of the arrow along which the circuit is by passed in Pic. 4.



Pic. 3. Scheme for testing the first Kirchhoff law



Pic.4. Scheme for testing Kirchhoff's second law

Having prepared the lesson “Studying the laws of Ohm and Kirchhoff” using the developed laboratory stand on solar cells, taking into account the individual abilities of students, you can be sure that students will feel comfortable in the lesson, everyone will do their best work, help a friend, believe in their strengths and capabilities. In such lessons, it is possible to vary the form of presentation of educational material through an object, image, word, practical modeling, organize activities along the chain: observation - reproduction - independent activity - solving problem situations - research - creativity.

#### Literature

1. Раушенбах Г. Проектирование солнечных батарей Перевод с английского – М.: Энергоатомиздат, 1993. 360 с.
2. [Muhammad H. Rashid](#). [Power Electronics Handbook](#). USA: Butterworth-Heinemann, 2017.
3. Розанов Ю.К., Рябчицкий М.В., Кваснюк А.А. Силовая электроника. Учебник. –М.: Издательский дом МЭИ, 2016.
4. [Branko L. Branko B.](#) USA: Springer International Publishing, 2015.

### **РАЗРАБОТКА ДАТЧИКА ИК – ИЗЛУЧЕНИЯ НА ОСНОВЕ КРЕМНИЯ С НАНОКЛАСТЕРАМИ АТОМОВ МАРГАНЦА ДЛЯ СИСТЕМ АВТОМАТИЗАЦИИ**

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Фотоприемники ИК излучения диапазона  $\lambda=10\div 2.5 \mu\text{m}$  востребованы преимущественно в качестве матричных телевизионных устройств для создания тепловизоров [1]. В матрицах, работающих, на собственном внутреннем фотоэффекте применяются такие материалы как: PbS, PbSe, InSb,  $\text{Ga}_x\text{In}_{1-x}\text{As}_y\text{Bi}_z\text{Sb}_{1-y-z}/\text{InSb}$ , (CdHg)Te и др. [1-4]. Однако создание