ISC0100 CYBERELECTRONICS

Fall 2018

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Learning environment : http://isc.ttu.ee
Materials : http://isc.ttu.ee/martin

Who I am ?

- Graduated Jõhvi Gümnaaium
- Phd degree from TUT
- Lecturer, elecronic engineer.
- www.skeemipesa.ee www.elfafoorum.ee

EESTI VABARIIK

TALLINNA TEHNIKAÜLIKOOL

DIPLOM

Tallinna Tehnikaülikool tunnistab, et

Martin Jaanus,

isikukood 37706162218,

on täitnud doktoriõppe

info- ja kommunikatsioonitehnoloogia õppekava

täies mahus ja talle on antud

filosoofiadoktori (arvuti- ja süsteemitehnika) kraad

Doctor of Philosophy (computer and systems engineering)

Rektor Andres Keevallik

Infotehnoloogia teaduskonna dekaan Ennu Rüstern

Tallinnas 10. juunil 2011. aastal

TALLINNA TEHNIKAÜLIKOOL TTÜ 1918

OB 000176

Cyberelectronics

- https://en.wikipedia.org/wiki/Cyber
- **Cyber-**, from "cybernetic", from the Greek for "skilled in steering or governing", may refer to:
- **Cybernetics**, a transdisciplinary study of control and communications.
- **Electronics** is the discipline dealing with the development and application of devices and systems involving the flow of electrons in a vacuum, in gaseous media, and in semiconductors.
- **Cyberelectronics** is missing in wikipedia.

Actually – Introduction to electronic

Covered topics

- DC-Sources , measurments , Ohm’s law,resistor, two-poles.
- AC, capacitor,inductor,
- Diodes, transistors, three-poles.
- Transients, time and frequency response
- Feedback, amplifiers.
- Digital blocks – levels , quantization,AD-DA converters

About course and learning

- Course uses isc system:

ISC.TTU.EE

- Online e-learning environment
  - Everything will be done there – online
  - Can be accessed everywhere
  - Automatic evaluation (no teacher intervention)

  100% web- based :
  - Internet is full of materials
  - Work in internet
  - communication in internet

  - ***This doses not exclude talking, asking, ..***

Assessment

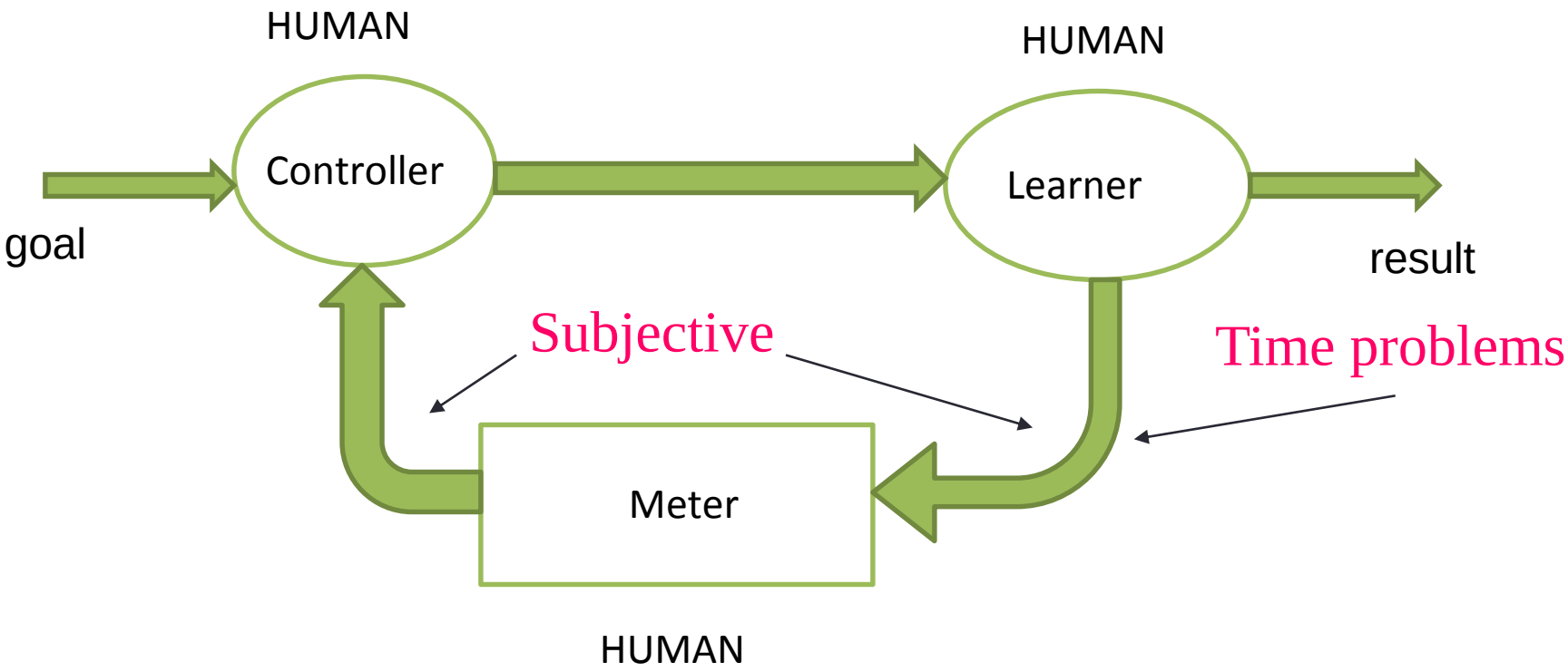
- No official final exam:
  - Grade will be earned over the semester
  - Student him/herself decides what grade to take (more later)
- Tasks & lab experiments
  - Task are small exercises that can be done anywhere
  - Lab experiments will need lab kit (can be borrowed or can be used on-site lab)
  - What we measure, that we get (Proverb of automation people).
  - I hear- I forget, I see- i can remember, I do – I understand (Confucius)
  - **The main goal – just to become smarter !**
  - **Subject ends at 23. January 2019 .**

Lectures

- Only first 4 week
  - „Learn by doing“
  - So, instead sitting in lectures, register to lab and start solving exercises.
  - I do not speak fluent Engilsh , as well as you. Much information will be lost !
  - The effectiveness of lecture is quite small.
  - You are different !!! (Skills, background, needs, motivation.)
  - We do’nt know your background !

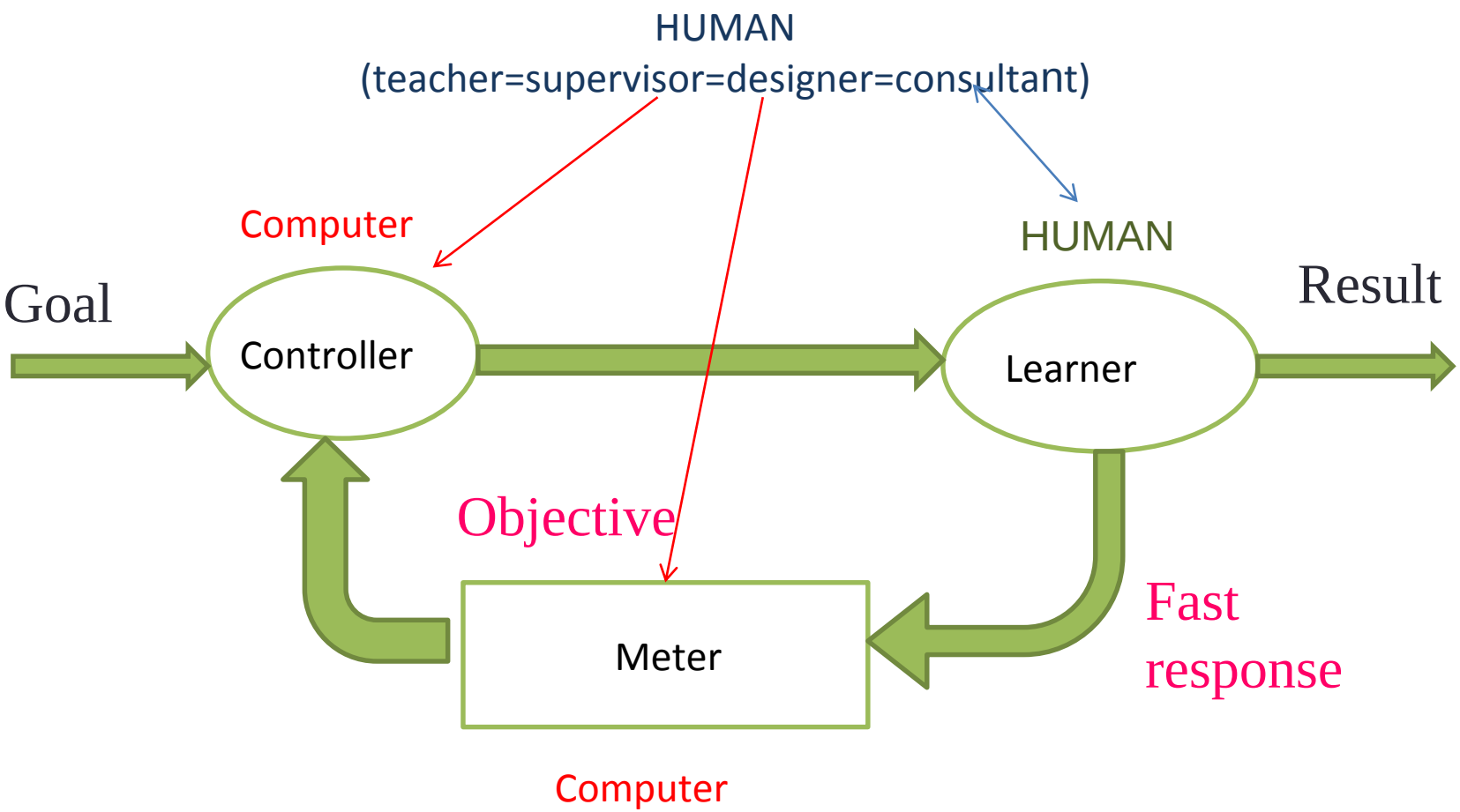
  - If wou want to listen very good lecure about electronics
  - http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/

Learning as Closed Loop System



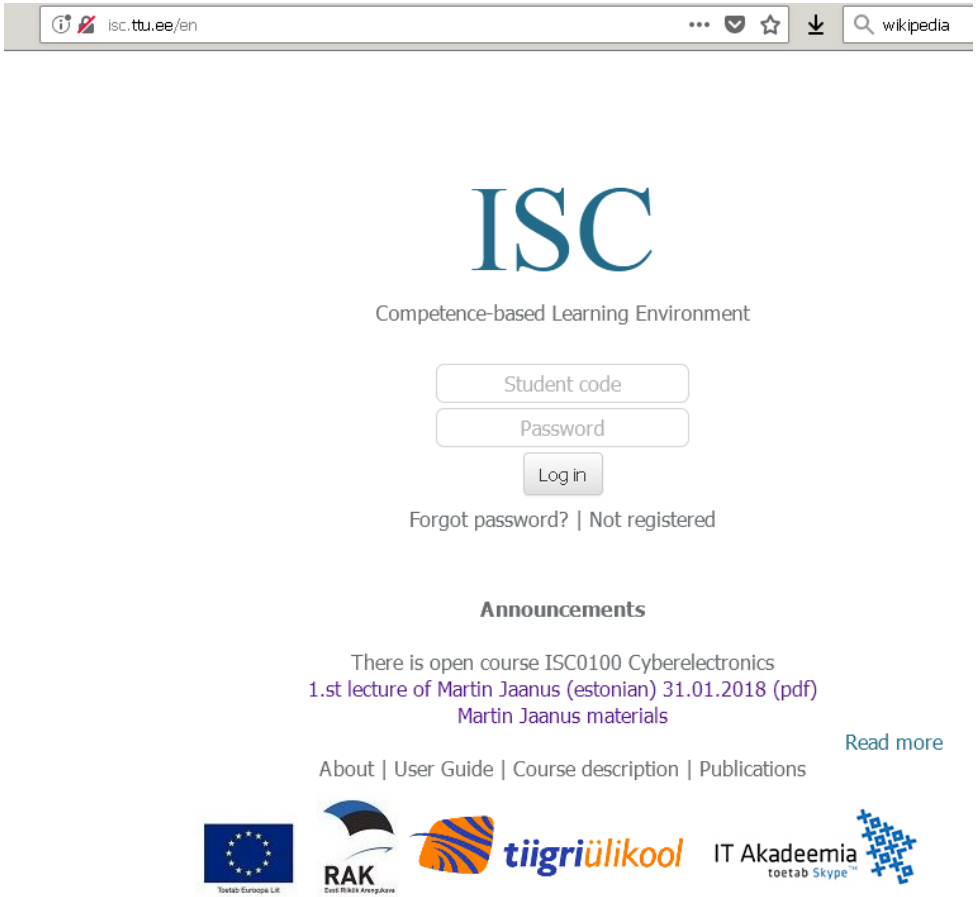
- E-tools only for organization

Learning as Closed Loop System



Learning environment

- http://isc.ttu.ee



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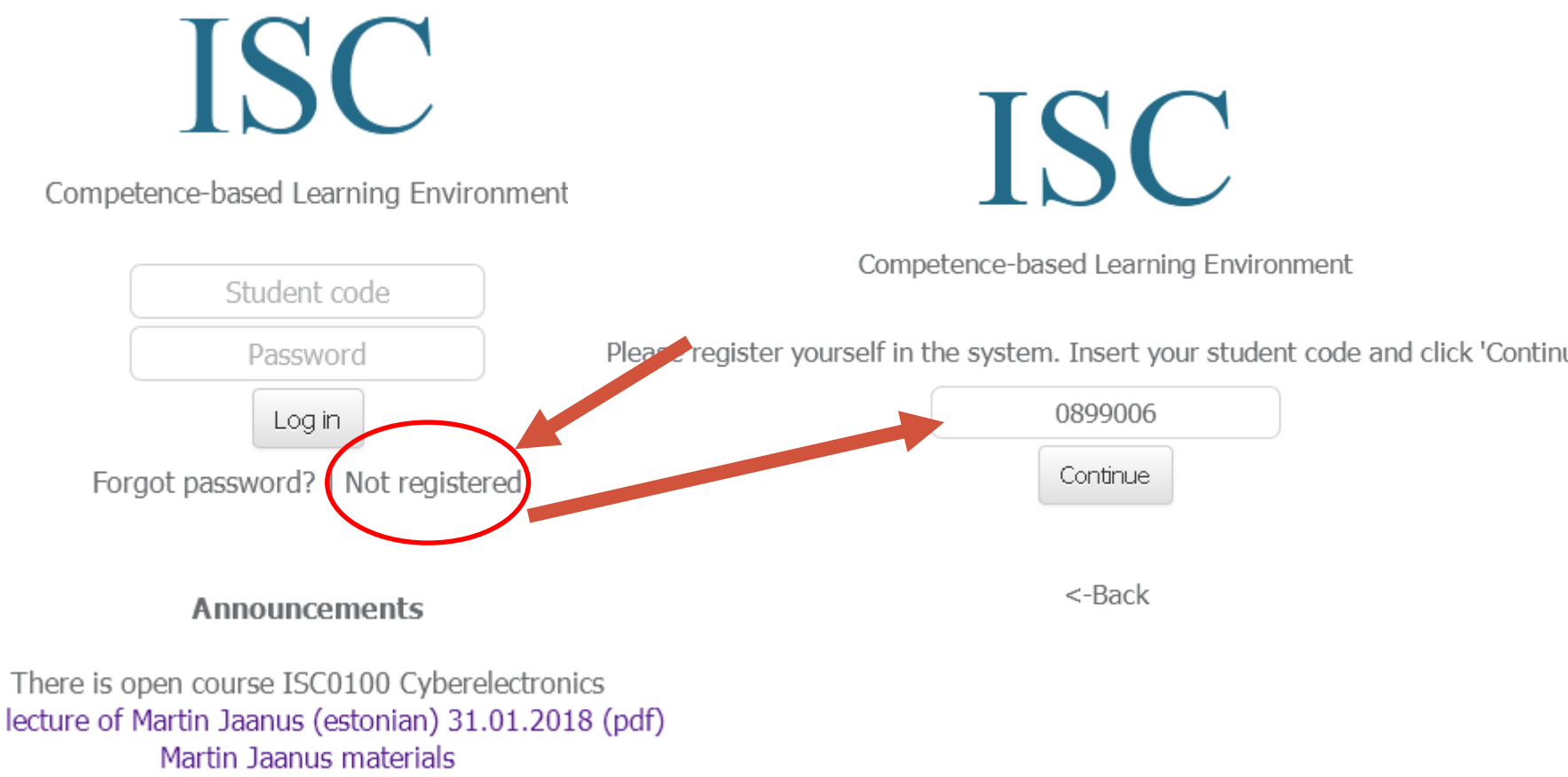
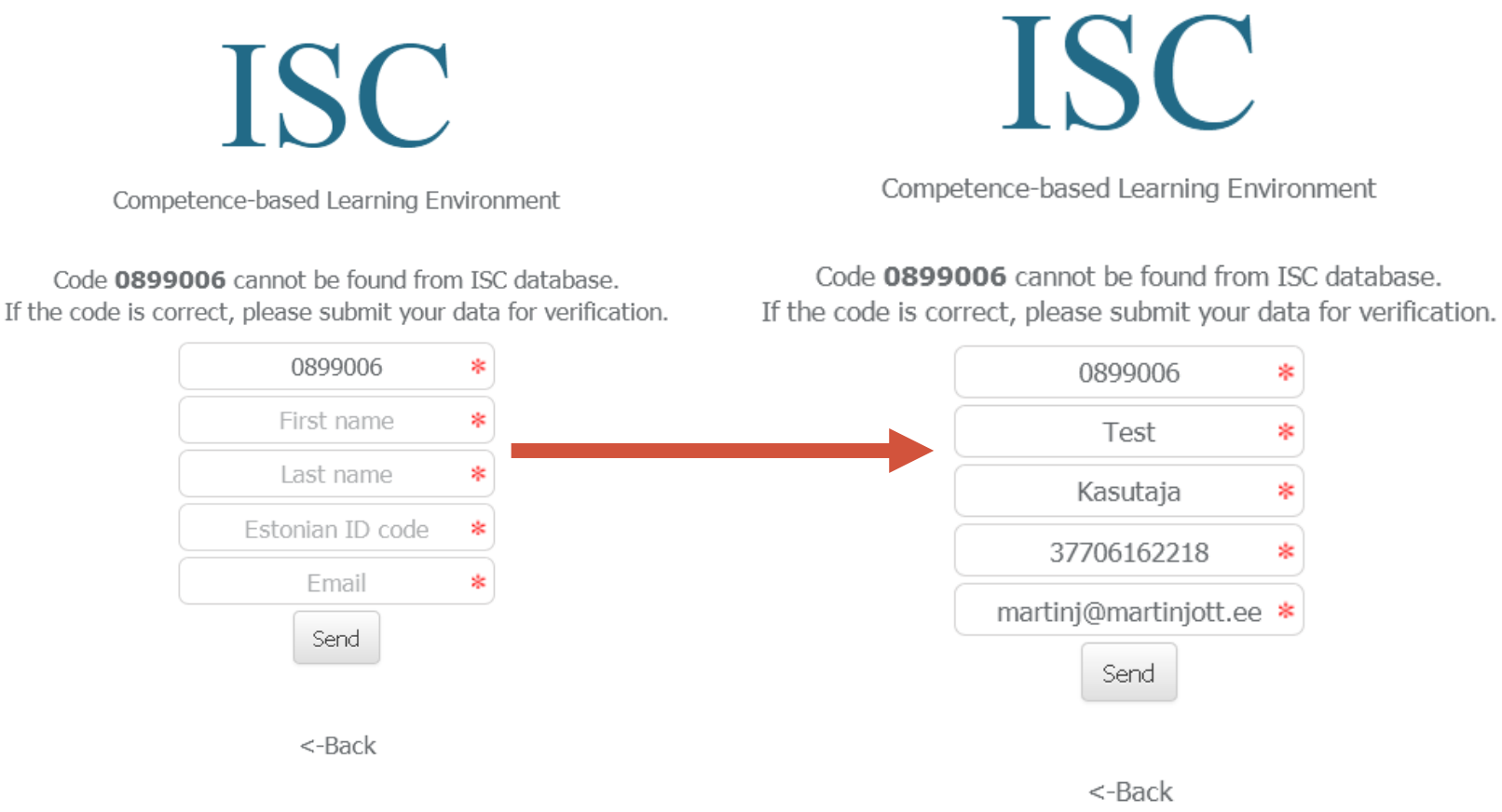


If you haven’t registered before:

...and you are not in database

Fill those fields carefullv !!!



If you haven’t registered before:

ISC

Competence-based Learning Environment

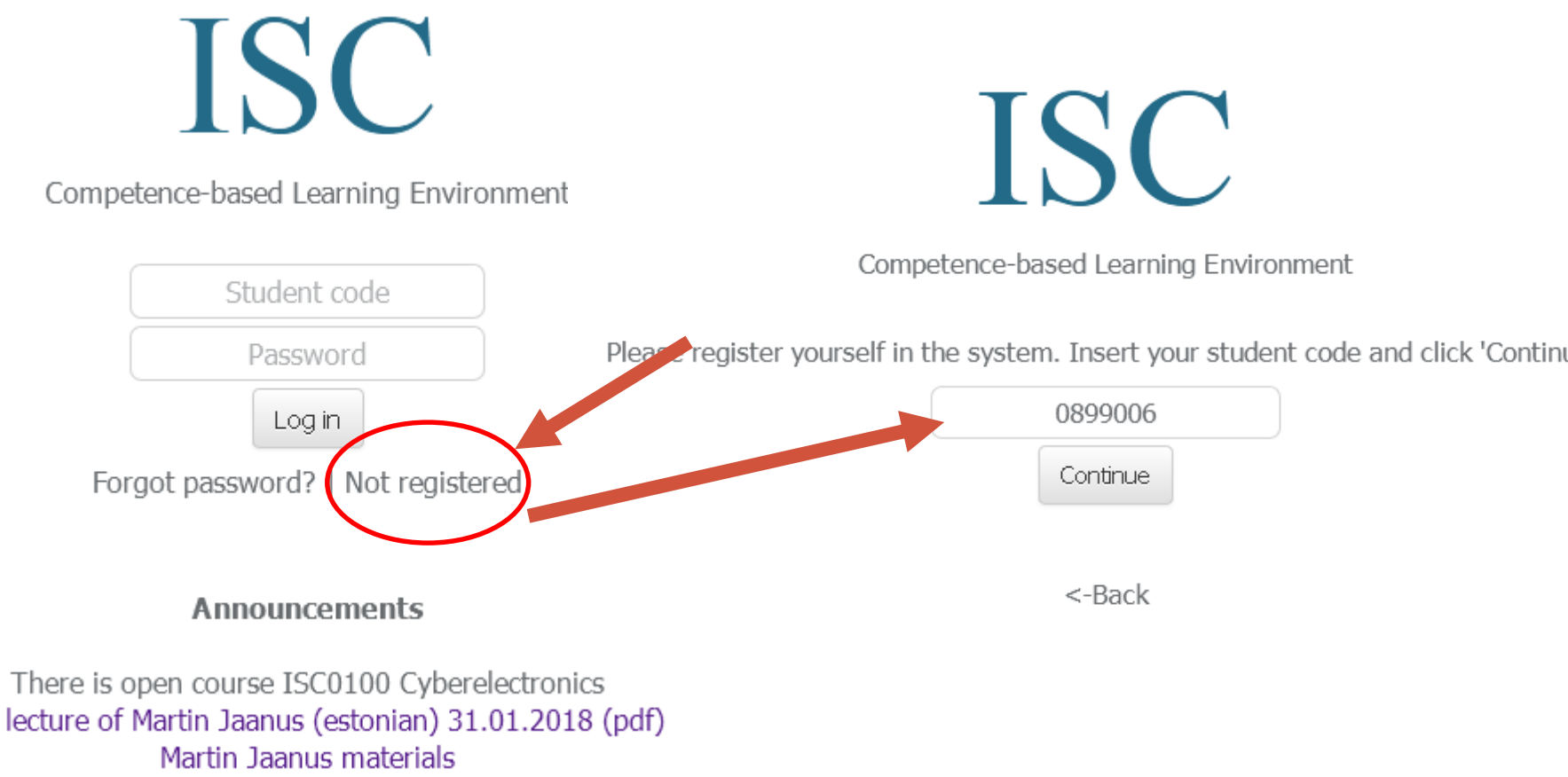
Data has been saved. You will be contacted when Your data has been verified.

<-Back

- Teacher must confirm you data. And you will get mail like this.

If you haven’t registered before:

- If you have teacher response



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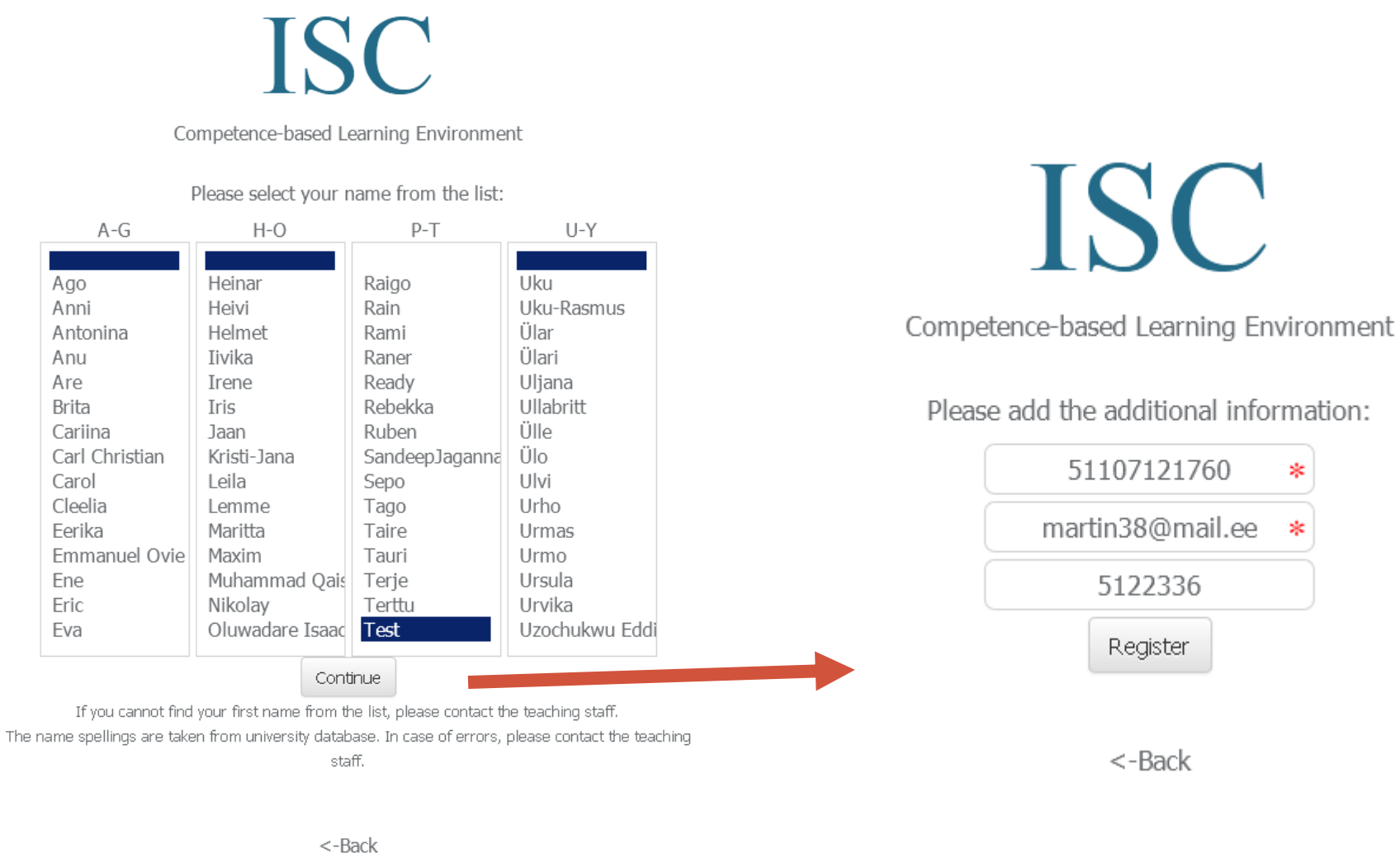
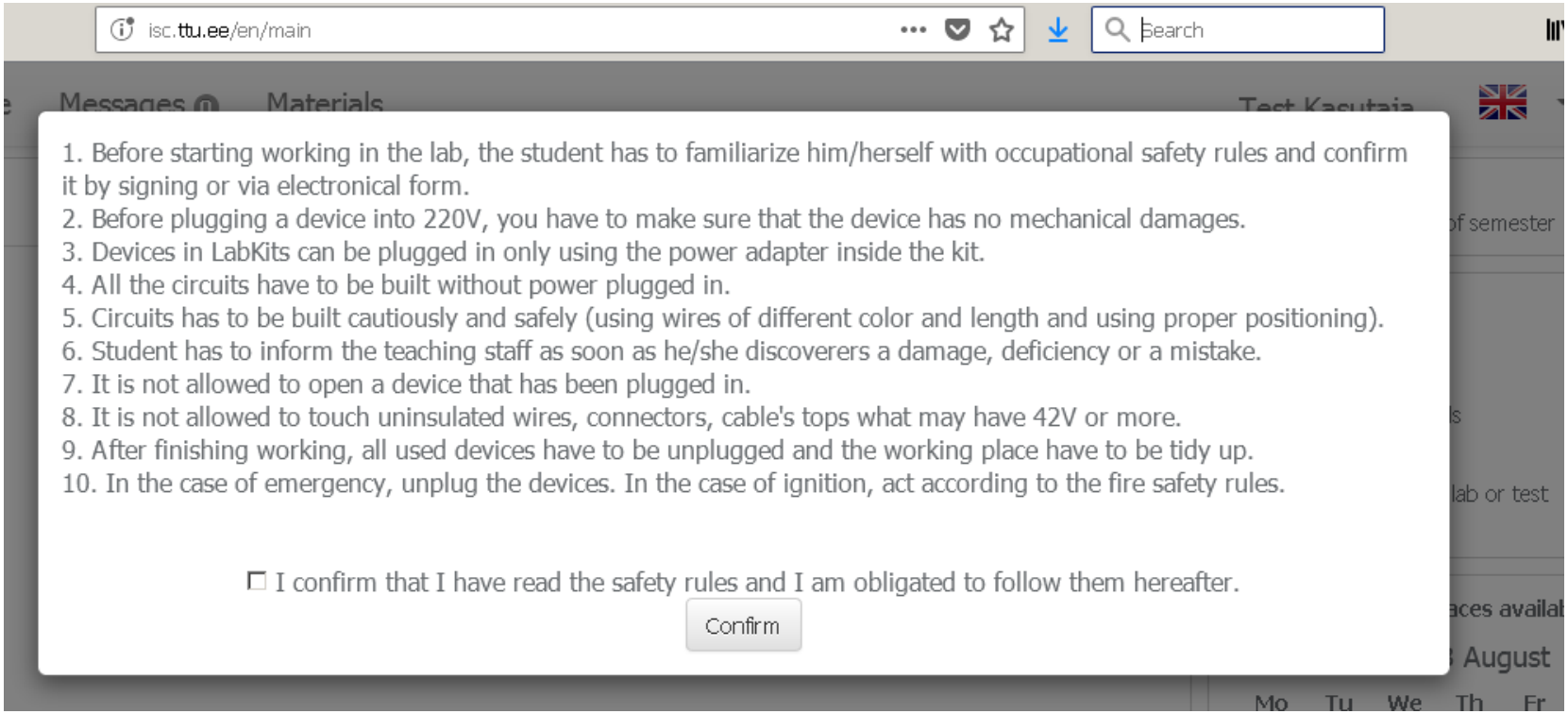


If you haven’t registered before:

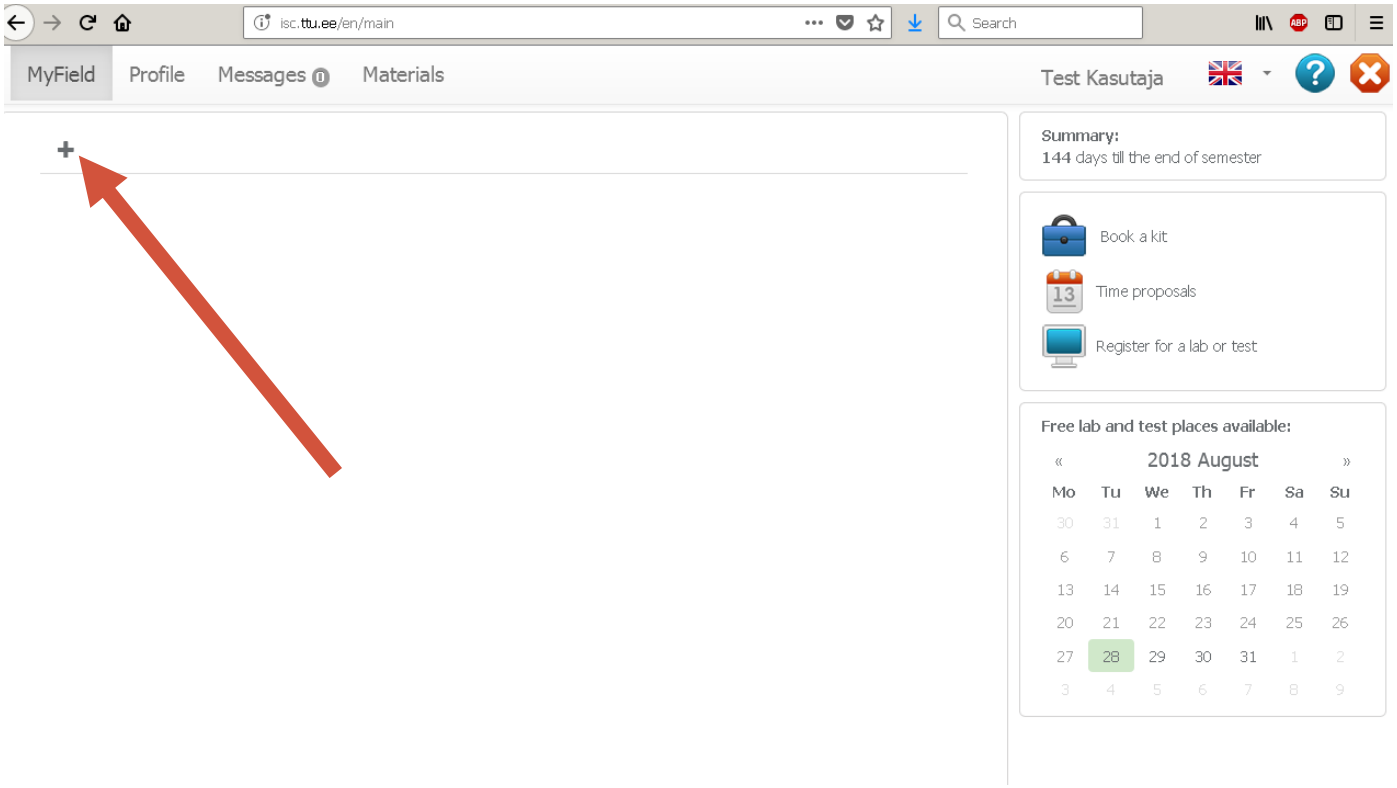
- You will get a password ! Remember it !
- The password can’t be changed.
- If you forget the password, ask us !

If you haven’t registered before:

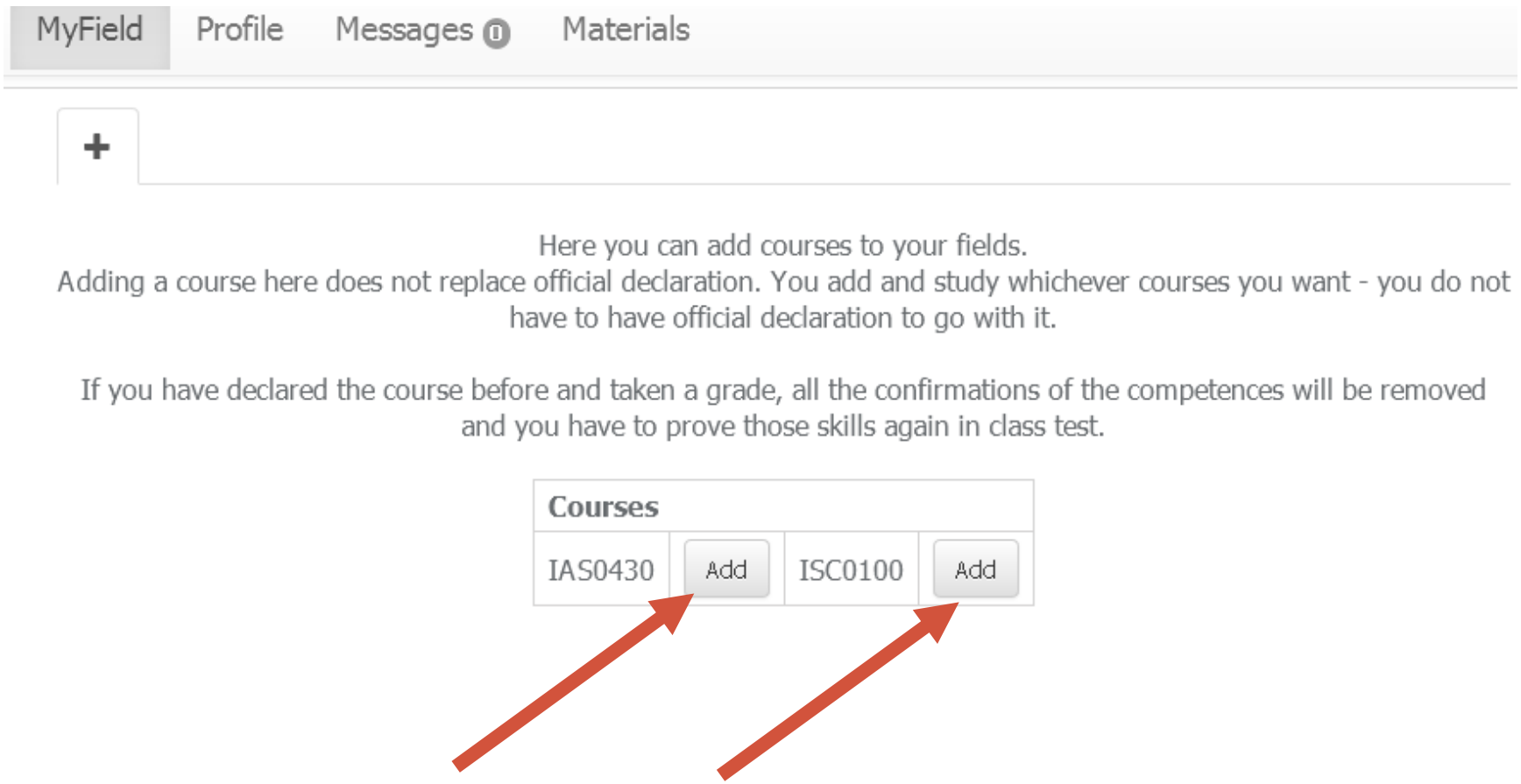
- You must agree..



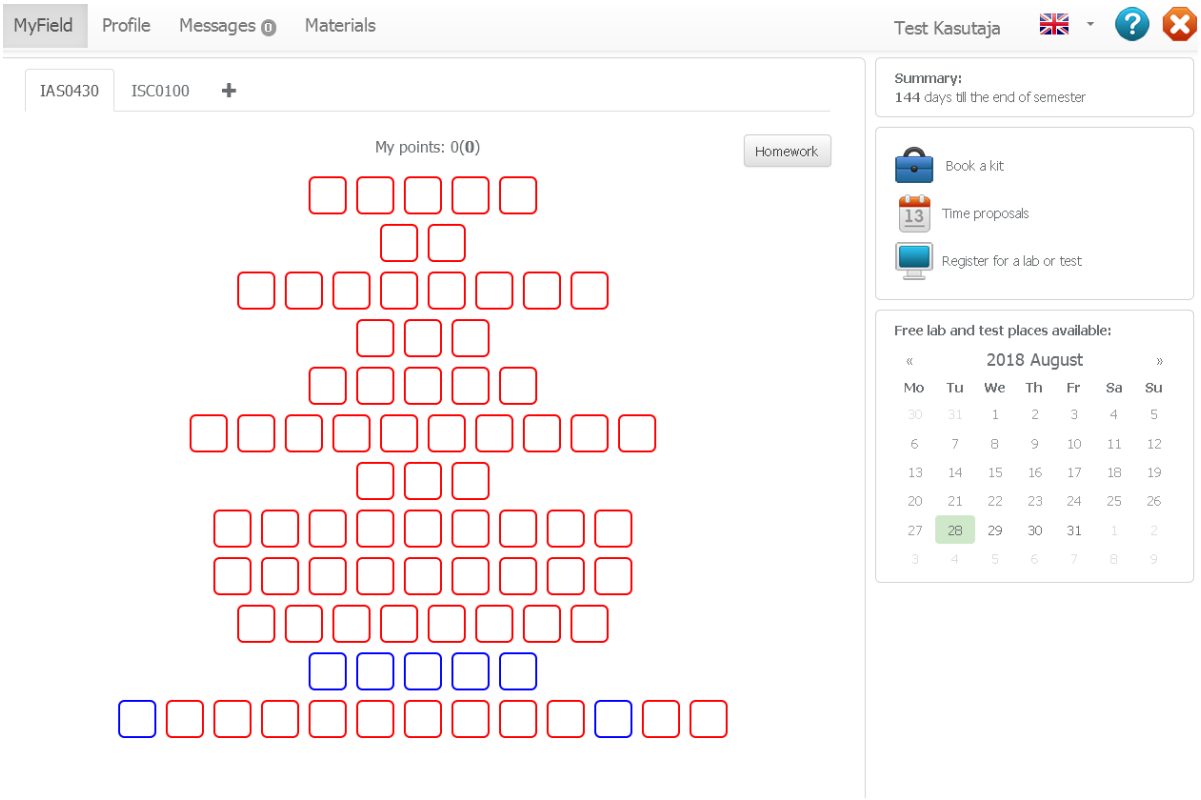
Adding new course



Adding new course



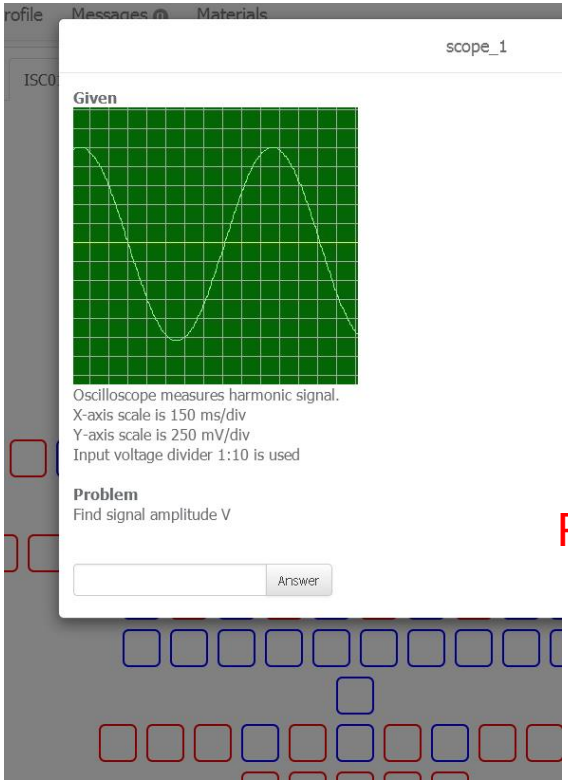
Done !



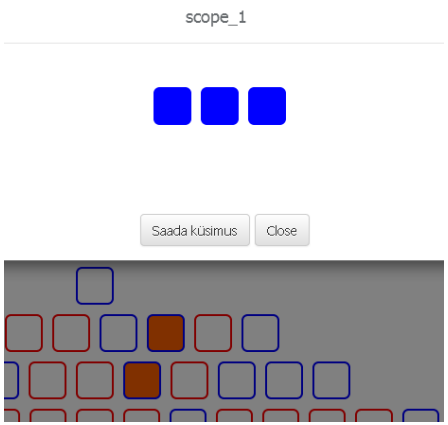
How to learn using this environment can be found here:
http://isc.ttu.ee/en/userGuide

Learning environment

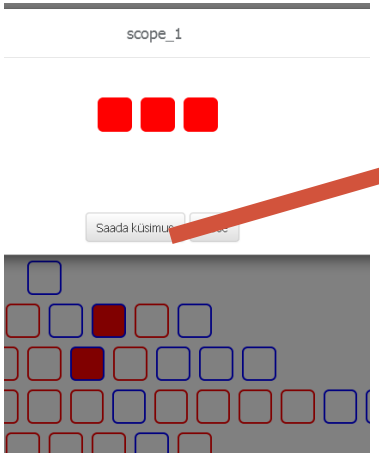
- Tasks



Result OK



Result NOT OK



Question to teacher about task.

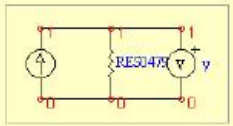
Learning Environment (labs)

Katse CS145

Pinge mõõtmine ja mõõteviga

Seadmed: vooluallikas, resistor RES0479, multimeeter DMM M830 ning multimeetri kasutusjuhend.

	Tulemus	Ühik
Mõõtepiirkond	20	V
Mõõta pinge V	4.2	V
Arvutada mõõteviga ±	48	mV



Pinget mõõdetakse **voltmeetriga**. Selleks ühendatakse voltmeeter ahelasse **rööbiti**. Valida tuleb optimaalne mõõtepiirkond ehk see, kus mõõteriista näit on suurim , kuid ei ületa skaala maksimumväärtust.
Tester näitab V klemmi pinget COM klemmi suhtes.

Result by components:

Lab tasks are included in Class Test !

Lab times

- On-site labs will consist of you working with a labkit on laboratory. There is someone there to help you with all the questions you have

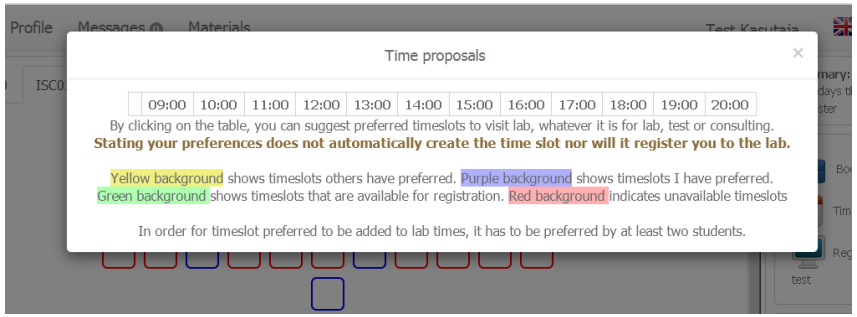
- You can start with few sessions on the lab and then do experiments home with borrowed HomeLabKit

Before you can borrow HomeLabKit, you have to go for a lab once

Labs

From next week .

You can use time proposial.

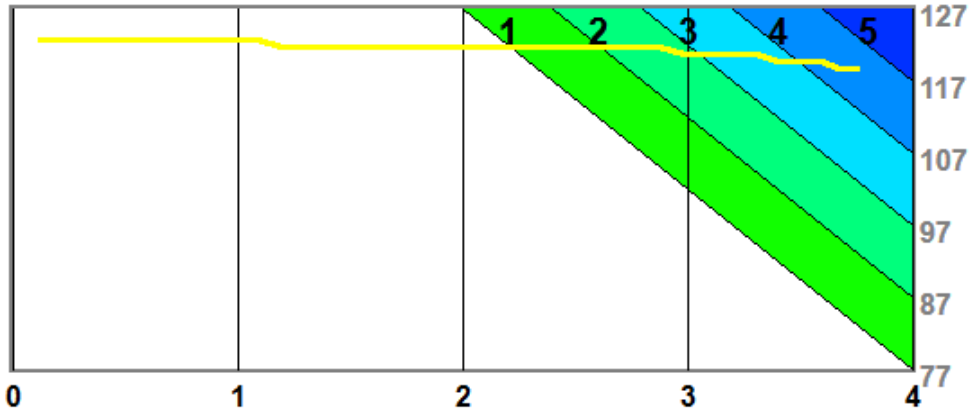


Class tests

- You work on your own and on lab until you have got the competences high (level over 77 of 127).
- If you have more than 1000 mCu, you can register for class test and come to lab to to class test.
- Same kind of exercises than before – you just have to do it in „controlled“ environment to prove you did it yourself
- All points have to be confirmed this way.
- Those points count towards your grade
- Class tests include lab tasks (not programming tasks) !

Grade taking

- You can take your grade whenever you want – when you have the points, take the grade and you are done. You do not have to wait till the end of semester



About doctors …

- You need to study…years (think the number by yourshelf)
- The doctors are under rigid supervision
- If the doctor errs , what will happen?

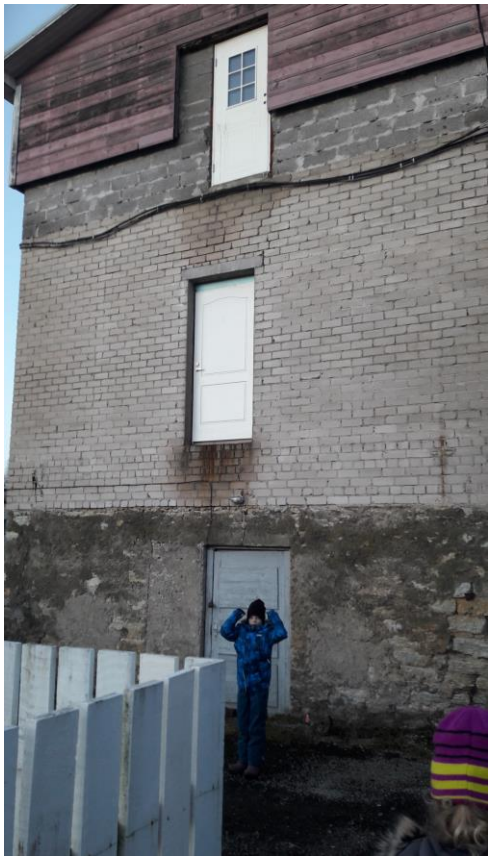
Image -lists10.com

Correct, but victim is usually one .

Result – Good days for yournalists, law court..etc.

About engineers…

- You need to study…years (think the number by yourshelf)
- The engineers are not under very rigid supervision
- If the engineer errs , what will happen?



About engineers…

You see, what will happen

Tens or hundreds of victims

Questions

- Who made a mistake?
- Whitch engineer made

a mistake ??

Photos: postimees.ee

- Who is guilty ?

- There are few justice solutions .

..But politicans take responsipility….

About politicans…

- You need to study…years to be a politican .
- Who is supervisior ?
- If the politican errs , what will happen?

Photos: postimees.ee

About politicans…

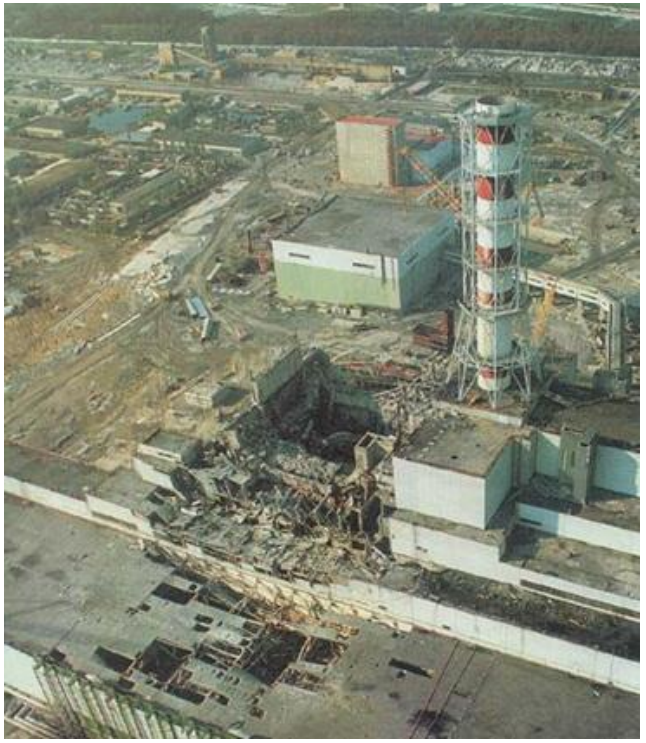
- Only one wrong word can destroy more people than may caused by collapsing any building.
- Who takes response ?

Image: delfi.ee

Why to study at university ?

- It is cheaper than in real life, much cheaper !
- If you err, you can try again .
- In real world there is no sutch possibility or it costs a lot of money.

The nuclear accident in Thernobol is good example.



Pilt : www.tuumaenergia.ee

From real life

The technican of IT company is making routine check of enviromental parameters in office .All is fine. Computers are working, the ligts are glowing normally. In addittion to other parameters there is needed to measure the mains voltage. He connects the multimeter into mains outlet ant it shows 462 V.

What should he do next?

Answer : To buy new multimeter .

Electric charge

- Electric charge is the main substance in the subject
- We are interesed in collecting , moving charges and related work.
- There is existing elementary carge, the smallest one.
- Electric carge are carryng subatomic particles, the most imortant is electron. The charge of electron is

$-1{,}6*10^{-19}$ C, where C is coulomb, the unit of electric charge.

Electronics moves direcions to use single electrons.

Voltage

Voltage, electric potential difference, electric pressure or electric tension (formally denoted ΔV or ΔU, but more often simply as V or U, for instance in the context of Ohm's or Kirchhoff's laws) is the difference in electric potential energy between two points per unit electric charge. The voltage between two points is equal to the work done per unit of charge against a static electric field to move the test charge between two points and is measured in units of volts (a joule per coulomb).

The volt (symbol: V) is the derived unit for electric potential, electric potential difference (voltage), and electromotive force. The volt is named in honour of the Italian physicist Alessandro Volta (1745–1827), who invented the voltaic pile, possibly the first chemical battery.

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Kirchhoff's voltage law

The directed sum of the electrical potential differences (voltage) around any closed network is zero, or:

More simply, the sum of the emfs in any closed loop is equivalent to the sum of the potential drops in that loop, or:

The algebraic sum of the products of the resistances of the conductors and the currents in them in a closed loop is equal to the total emf available in that loop.

The sum of all the voltages around a loop is equal to zero. v1 + v2 + v3 - v4 = 0

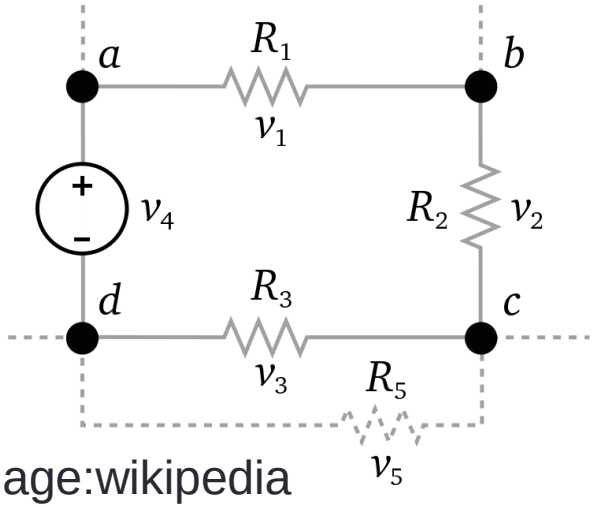


Image:wikipedia

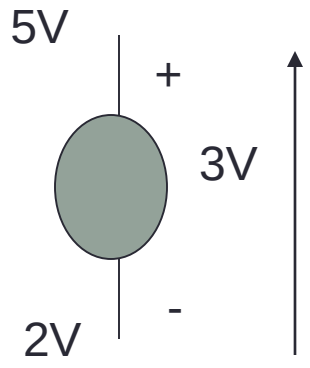
How to find the voltages?

Voltage is difference of potentials !

1.We choose a node in circuit and say that it is 0 V.
(usually this „ground“ node is set in cirtuit)
2. We find voltages related to this node.

How to find the voltages?

If we move from negative node to positive, the rise
Of voltage is positive.
.



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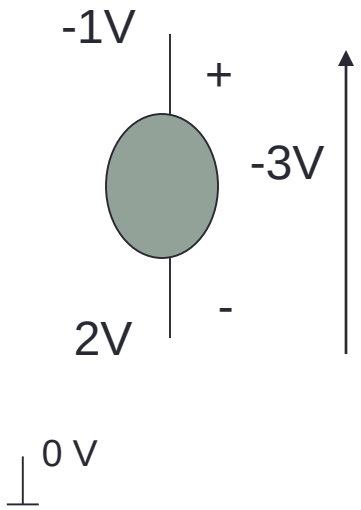

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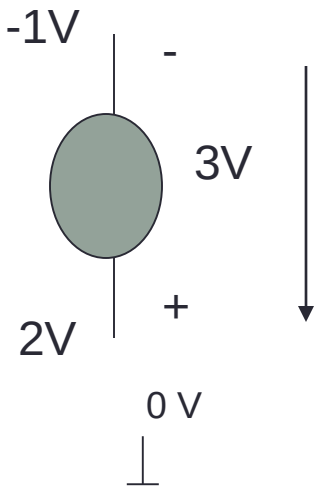


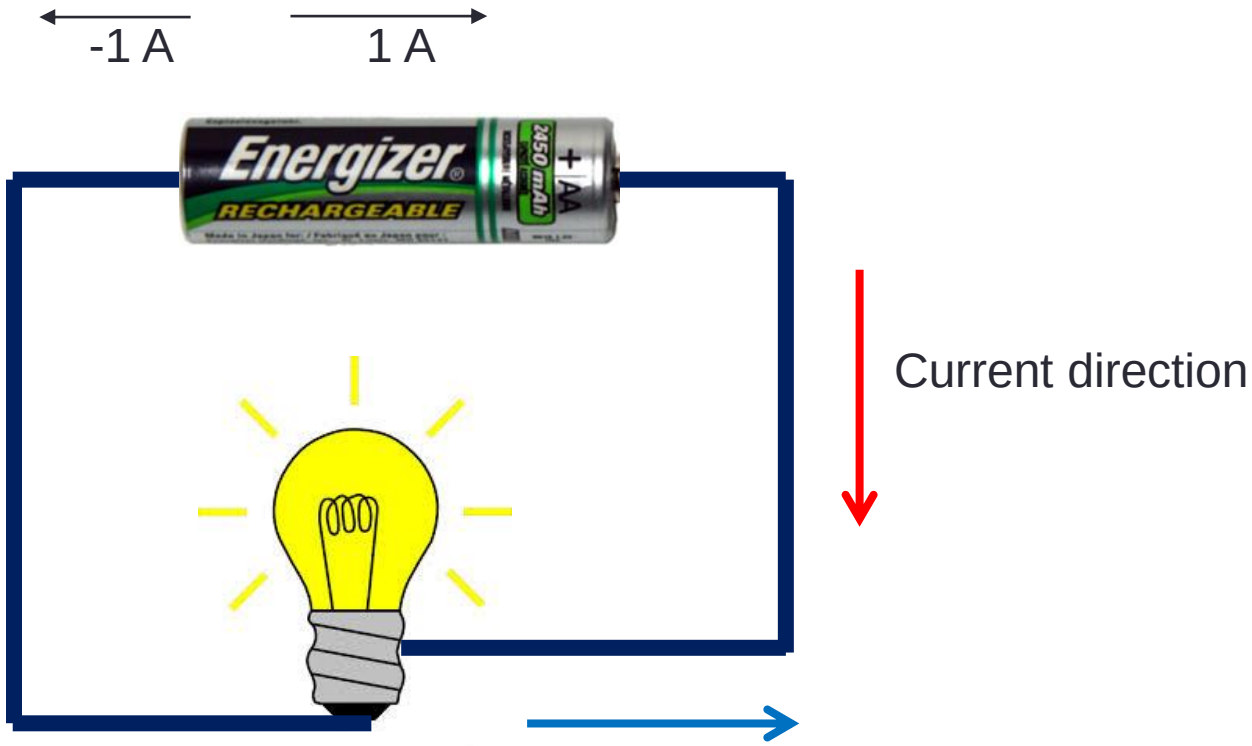
Current

An electric current is a flow of electric charge. In electric circuits this charge is often carried by moving electrons in a wire. It can also be carried by ions in an electrolyte, or by both ions and electrons such as in a plasma.

The SI unit for measuring an electric current is the ampere (A), which is the flow of electric charge across a surface at the rate of one coulomb per second.

Current

To get continious current the circuit must be closed !
The value of current is the same in closed loop!



Why wall outlets have two holes ?

Current

To get continious current the circuit must be closed !
The value of current is the same in closed loop!

Ony one interruption is needed

Why wall outlets have two holes ?

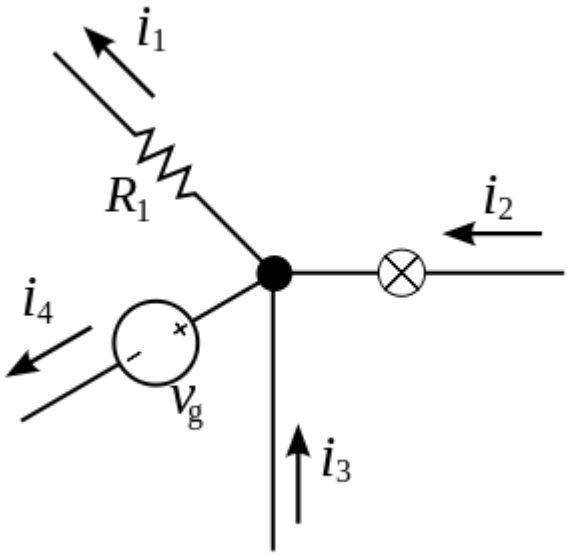
Kirchhoff's current law

At any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node

or equivalently

The algebraic sum of currents in a network of conductors meeting at a point is zero.

The current entering any junction is equal to the current leaving that junction. i2 + i3 = i1 + i4



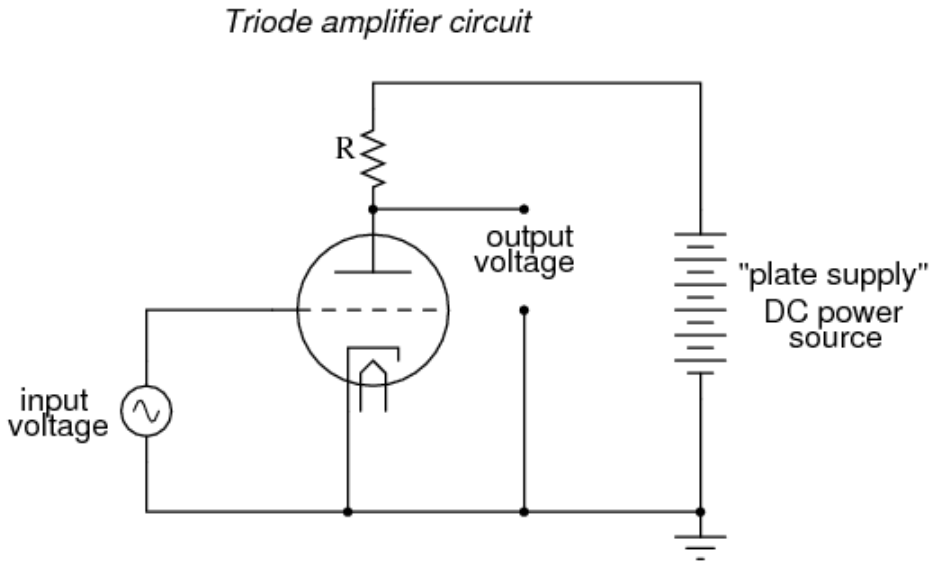
Electrical resistance and conductance

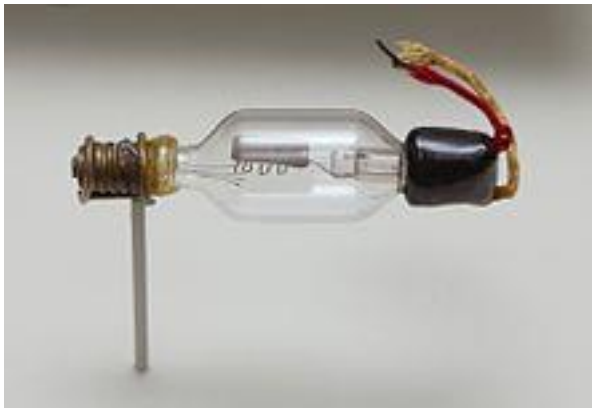
The electrical resistance of an electrical conductor is a measure of the difficulty to pass an electric current through that conductor. The inverse quantity is electrical conductance, and is the ease with which an electric current passes. Electrical resistance shares some conceptual parallels with the notion of mechanical friction. The SI unit of electrical resistance is the ohm (Ω), while electrical conductance is measured in siemens (S).

An object of uniform cross section has a resistance proportional to its resistivity and length and inversely proportional to its cross-sectional area. All materials show some resistance, except for superconductors, which have a resistance of zero. $G=1/R$ and $R=1/G$

About history

- The birth of electronics is at 1906, when engineer in USA Lee De Forest invented Audion (electronic valve – triode). Valve with two electrodes– diode 1904)
- This gave possibility to control movement of lagre amount energy using smaller energy (amplification).

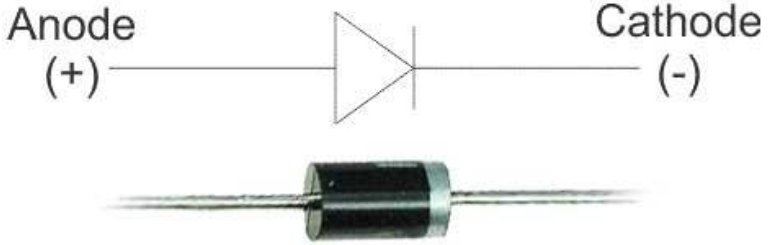




Pilt- wikipedia (Audion 1906)

About history(2)

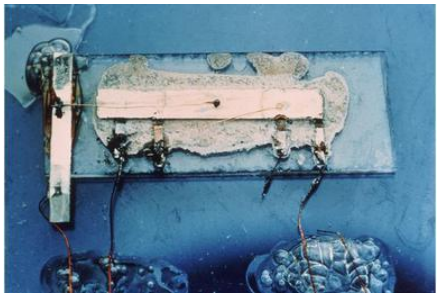
- The semiconductor diode (Crystal diode) comes from year 1874, when German scientist Ferdinand Braun discovered semiconductor effect in crystals.
- Singularity of diode – to make different resistance depending direction of charge flow.



Pilt- wikipedia (Crystal detector)

About history (3)

- The birth of tranistor is at 1947 , when John Bardeen, William Shockley and Walter Brattain were demonstrating bipolar transistor.
- Field effect transistor was patented at 1925 but it was only an idea.
- 1951 – was possible to buy transistors from store.
- 1953 – The first computer based on transistors.
- 1954 – The first silicon transistor.
- 1958 – The first integral circuit.



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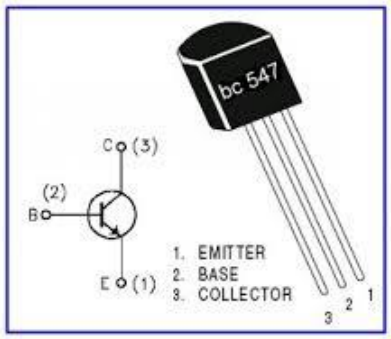
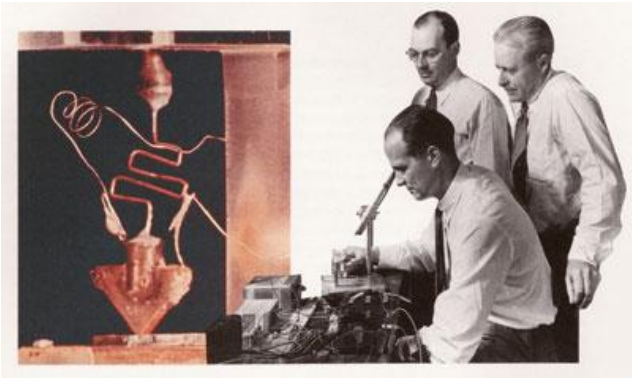
- 2016 - 25 millions of transistors per 1 cm^2 .





Images- wikipedia (Transistor)