TUHH
Technische Universität Hamburg

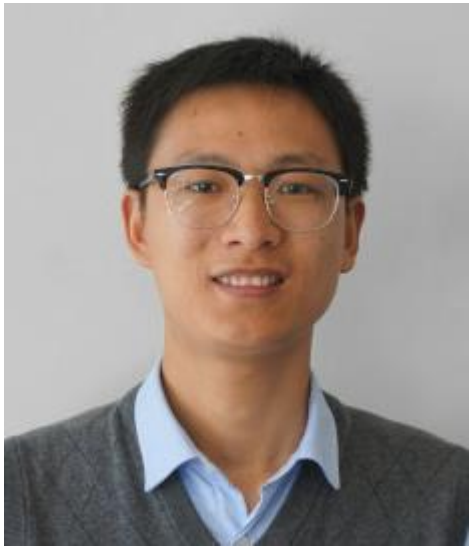
Course Overview, Winter Term 2022-2023

Electrical Engineering I

DC Networks and
Electro-Magnetic Fields

Dr. Cheng Yang

Preface



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Course Information

Elements of the Lecture

Lecture

This course will be given on campus, the COVID rules of TUHH have always to be observed (3G, face mask, distance, …)

The lectures has ben recorded by Prof. T. Kusserow and will be uploaded (slides, annotation, audio) later in StudIP

Exercises

Each week exercises on the topics of the lecture will take place

There will be a group on campus, with tutor and students in one room as long as this is possible.

Exam

Date: will be announced

Duration: 100 minutes

Content: everything

Permitted Resources:

- one handwritten sheet with formulas, two-sided, DIN A4
- calculator, non-programmable/no graphics output (no smartphones!)

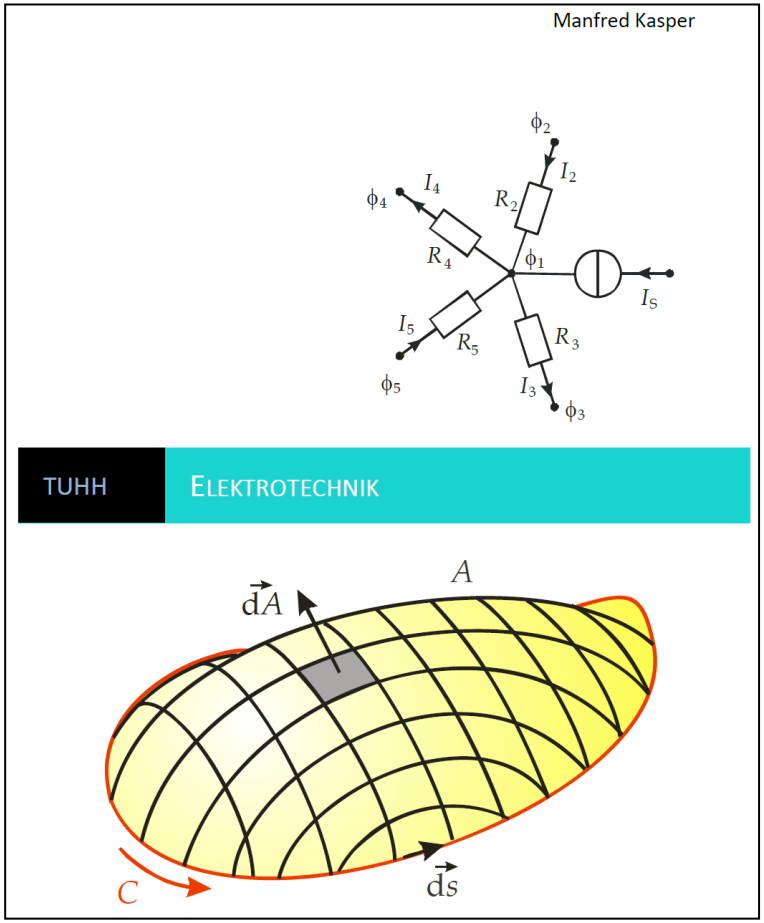
Resources for Lecture

All resources are available through Stud.IP

- lecture slides
- video files of lectures
- exercise problems

Exception: a printed script

- at Campus Shop: 6.00 €
- electronic version in Stud.IP



Exercises in Groups

- Most exercise groups in German
- 2 exercise groups in English (for GES students)
- As long as it is possible, one exercise group is on campus allowing direct contact between students and tutors
  - During the exercises it is of course mandatory to obey the COVID hygiene rules of TUHH at all time

First exercises take place in the week of October 24-28

Concept of Exercises

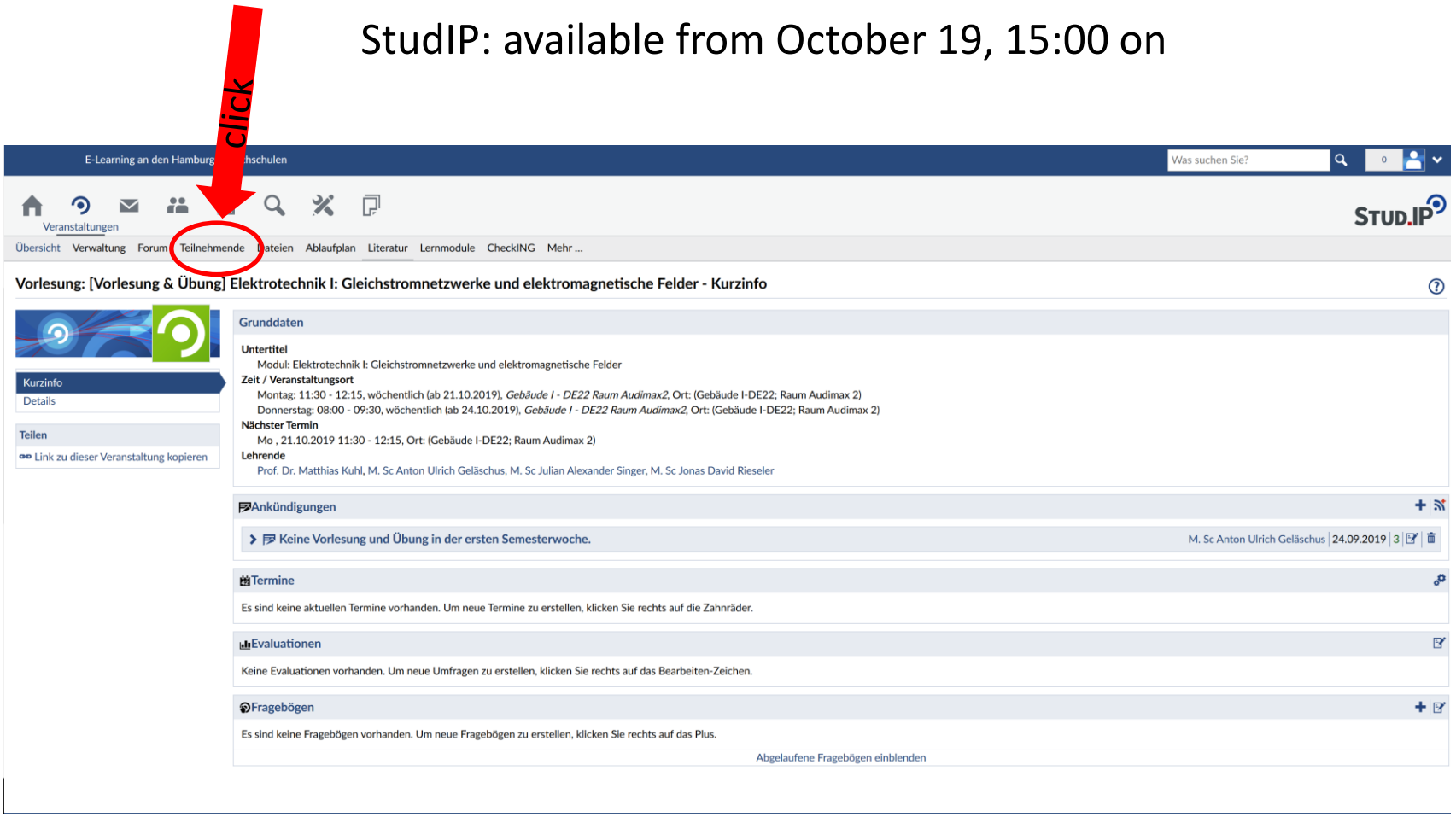
One part as home work, one as problem solved in exercise

- Home work is voluntary (but strongly recommended)
  - Helpful to prepare for the problem in the exercise
  - Will deal with most formulas which are required for the exercise

- Problems in the exercise will be solved with the help of tutors at TUHH
  - Only if you prepare, you will be able to ask questions on topics you did struggle with (and learn something by it)!
  - Duration of the exercises is rather short, so use the time wisely!

Sign-In for Exercise Groups

StudIP: available from October 19, 15:00 on



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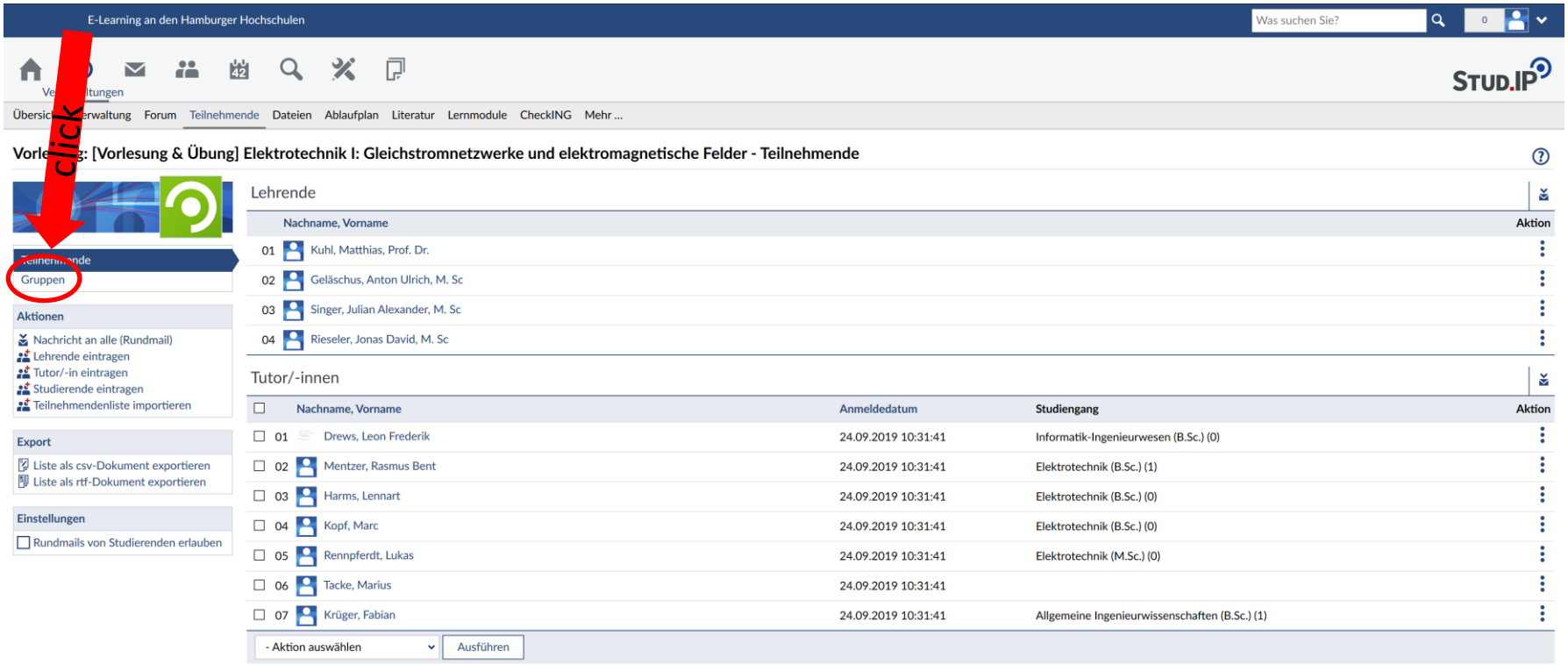

Sign-In for Exercise Groups

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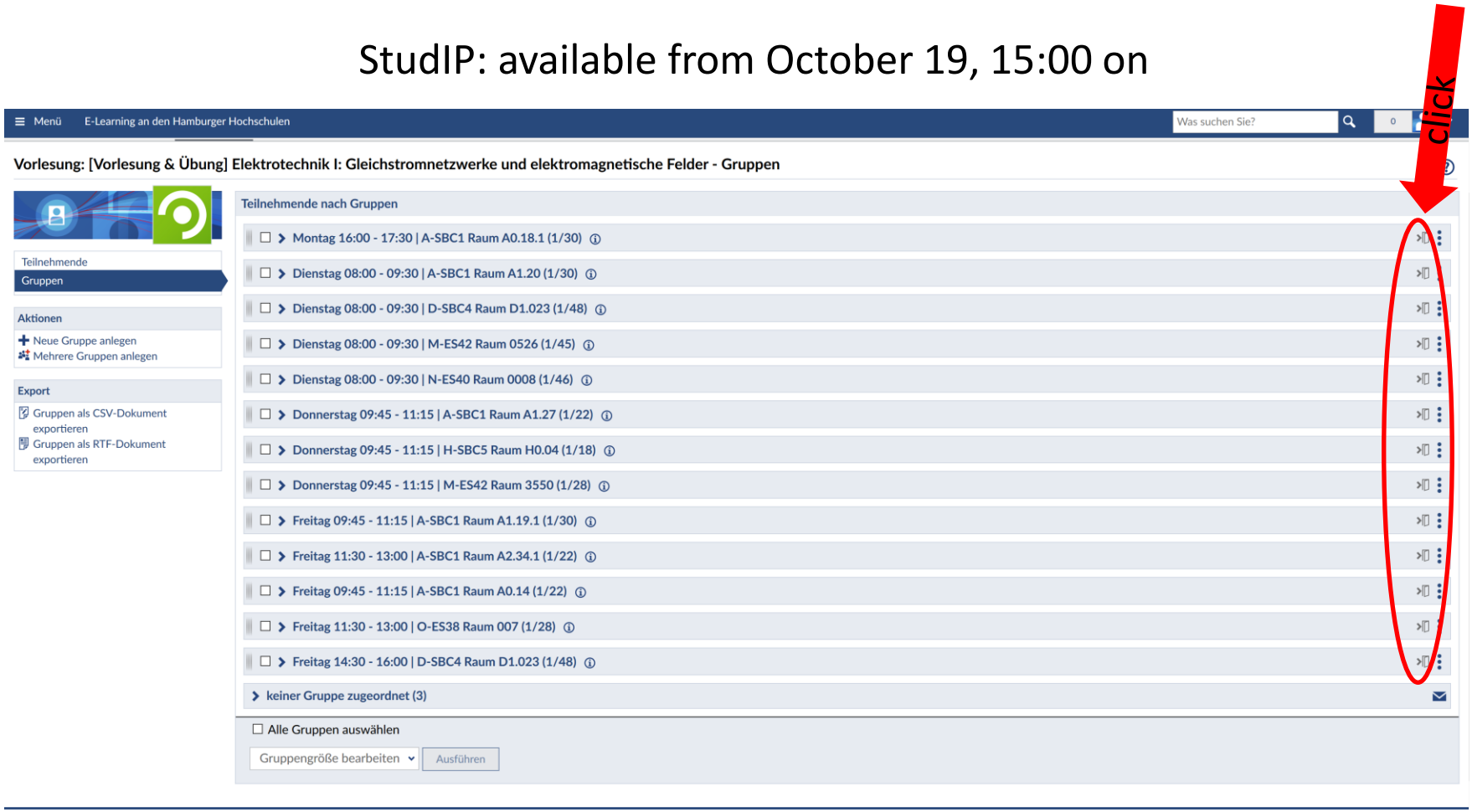


Online Tests During the Semester

Goal

Preparing for exercises,
Learn about your strengths and weaknesses
Gain deeper knowledge

Procedure:

The online tests are available in the eTeaching platform **ILIAS**. Participation is only possible in a limited time frame, which is given in the table.

First Online Test: October 24 at 12:00 (test run)

Online Tests During the Semester

Sign-In to ILIAS
Refer to manual: *Information on the Online Test*

Types of Tests
Multiple-Choice, Single-Choice, calculations or text questions

Given Time for Tests
Mostly 30 min. should be sufficient
Time limit (in most cases one hour).
You may only try once

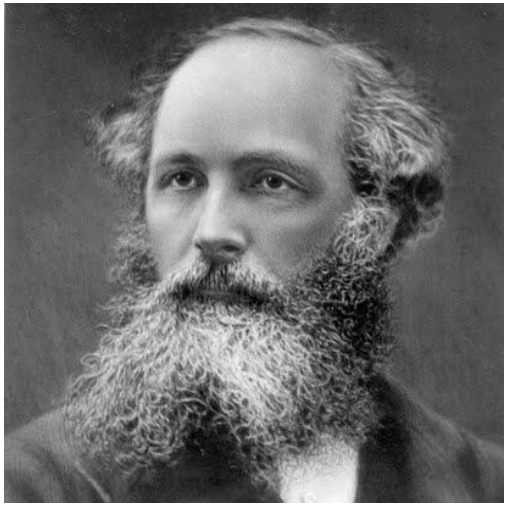
Input
Calculation results have to be given as number not as ratio (i.e. 0.5 not 1/2)
A precision of four valid digits is requested (e.g. 3.142).
Use exponential form for large or small values (e.g. 1.602E-19)

First Online Test: October 24 at 12:00 (test run)

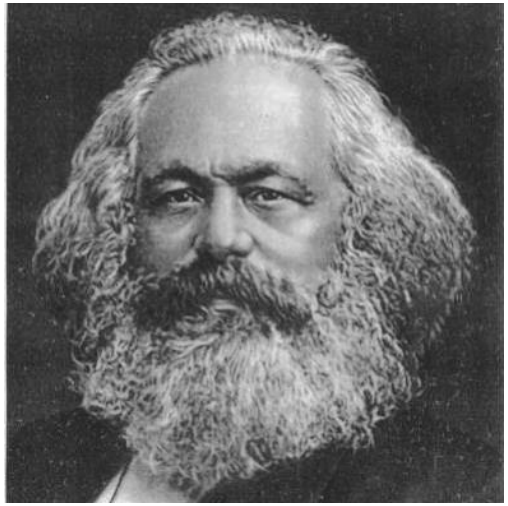
Maxwell

Quiz

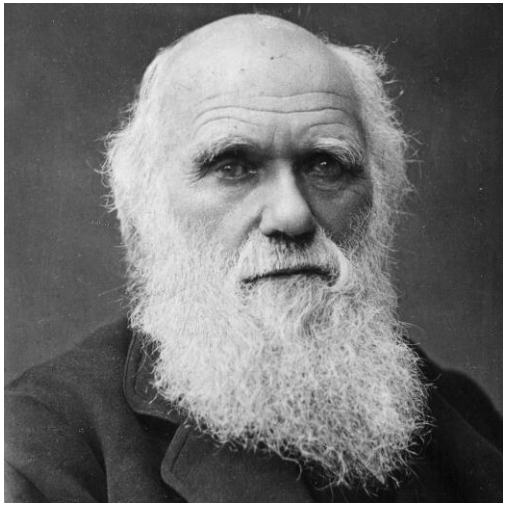
A



B



C



Which photograph shows James Clerk Maxwell?

A)

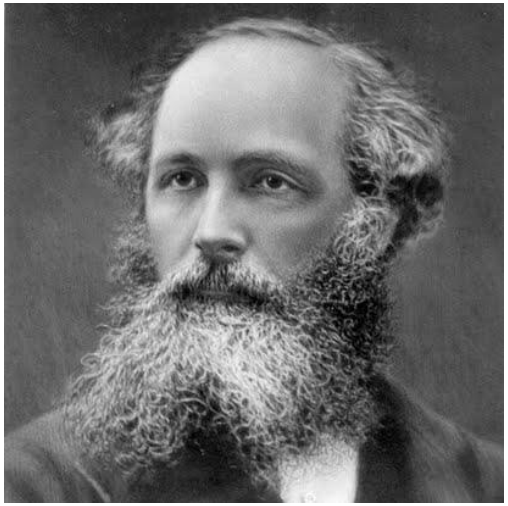
B)

C)

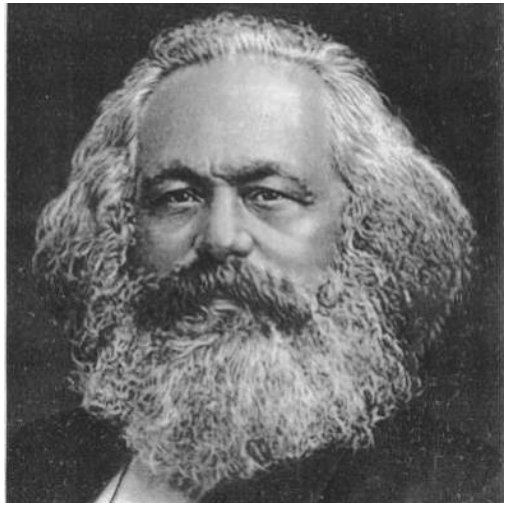
Maxwell

Quiz

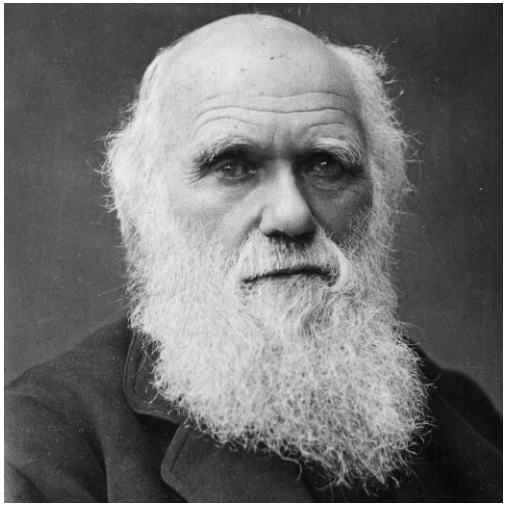
A



B



C



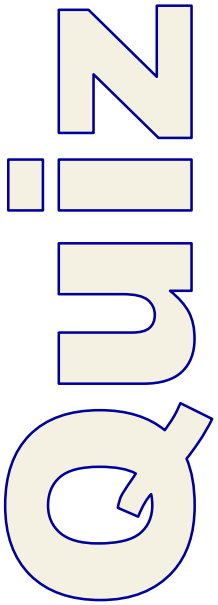
Which photograph shows James Clerk Maxwell?

A) correct!

B)

C)

Temperature Dependence



Is the following statement correct?

The temperature dependence of the electrical resistance is mainly given by the thermal expansion.

A) Yes, exactly

B) No, because then the temperature coefficient would be always negative

C) No, it is because with higher temperature the number of free electrons is reduced

Voltages

QUIZ

Is the following statement correct?

The origin of negative voltages is an excess of electrons.

A) Yes, exactly

B) No, it is the lack of electrons

C) No, voltage is linked to the potential energy related to a charge

D) No, negative voltages do not exist at all

The Quandary of Electrical Engineering
- Technical vs. Physical Current Flow -

[https://xkcd.com/567/]

Literature List (some suggestions)

- Allan R. Hambley: „Electrical Engineering“
  ISBN 978-0-13-206692-1
- Manfred Albach: „Grundlagen der Elektrotechnik 1“
  ISBN 3-8273-7106-6
- Paul M. Fishbane et. al.: „Physics“
  ISBN 0-13-231176-3

- Edward M. Purcell (+ now David Morin): “Electricity and Magnetism”
  ISBN 978-1-107-01402-2
- David J. Griffiths: “Introduction to Electrodynamics”
  ISBN 1108420419

- http://www.elektronik-kompendium.de/
- Online course of international universities (MIT OpenCourseWare, …)

Lecture Schedule 2022 / 2023

Week	Dates	Content of Lecture	Chapter in Script	Literature*	Exercises	ILIAS
1		Orientation week				
2	25.10. 27.10.	• Introduction • Base parameters of electrical circuits • Ohm's law • Specific resistance and temperature dependency • Circuit symbols and circuit diagrams • Voltage and power	1.1 – 1.3	A: 2.1 – 2.7 H: 1.1 – 1.3	-	27.10.- 31.10.
3	01.11. 03.11.	• Kirchhoff's current law • Kirchhoff's voltage law • Resistors in series or parallel configuration	1.4 – 2.1	A: 3. – 3.5 H: 1.4 – 2.1	Sheet 1	03.11.- 07.11.
4	08.11. 10.11.	• Δ-Y transform (delta-wye) • Voltage and current dividers • Voltage and current sources • Equivalent voltage and current source circuits	2.2 – 2.4	A:3.5 – 3.7 H: 2.2 – 2.3, 2.6	Sheet 2	10.11.- 14.11
5	15.11. 17.11.	• Wheatstone bridge • Superposition • Power matching • Efficiency	3.1 – 3.6	A: 3.8-3.9 H 2.6-2.8	Sheet 3	17.11.- 21.11.
6	22.11. 24.11.	• Electrostatic field • Coulomb's law • Strength of the electric field • Charge distributions	4.1 – 4.3	A: 1.1-1.8 F: 22, 23 P: 1.1-1.7	Sheet 4	24.11.- 28.11.
7	29.11. 01.12.	• Work and electrical potential • Electric voltage • Steady currents, current density	4.4– 4.5	A: 1.9 – 1.13 F: 23, 25 P: 2.1-2.5	Sheet 5	01.12.- 05.12.
8	06.12. 08.12.	• Calculating resistances • Power density • Boundary conditions of conductors	5.1 – 5.4	A: 2.1 – 2.9 F: 27 P: 4.1-4.5	Sheet 6	08.12.- 12.12.

Lecture Schedule 2022 / 2023

9	13.12. 15.12.	• Electric flux density • Gauss's law • Boundary conditions of insulators • Capacitance	6.1 – 6.3	A: 1.14–1.21 F: 24, 26 P: 3.5-3.7, 10	Sheet 7	15.12.- 19.12.
10	20.12. 22.12.	• Capacitors in electrical networks • Energy of the electric field • Permanent magnets, magnetic field • Ampère's circuital law • Biot-Savart law	6.4 – 6.5	A: 1.18 – 1.21 F: 30 G: 4.1-4.2 P: 6.1-6.2	Sheet 8	22.12. - 26.12.
11	10.01. 12.01.	• Magnetic materials • Magnetic circuits • Magnetic resistance • Analogies to electrical circuits	7.1 – 7.4	A: 5.1–5.14 F: 32 P: 11	Sheet 9	12.01.- 16.01.
12	17.01. 19.01.	• Faraday's law of induction • Lorentz force • Force in a magnetic field	8.1 – 8.2	A: 6.1 – 6.2 F: 29, 31 P: 7	Sheet 10	19.01.- 23.01.
13	24.01. 26.01.	• Inductance • Coils in electrical networks • Energy of the magnetic field	8.3 – 8.5	A: 6.2 – 6.3, 6.5 – 6.6 F: 33	Sheet 11	26.01.- 30.01.
14	31.01. 02.02.	• Inductive coupling • Maxwell's equations	8.5 – 8.6	A: 6.4 P: 7	Sheet 12	

* **H**: Hambley: Electrical Engineering

F: Fishbane et. al.: Physics

A: Aalbach: Grundlagen der Elektrotechnik

P: Purcell: Electricity and Magnetism

G: Griffiths: Introduction to Electrodynamics