

Introduction

to the Physics Laboratory for Civil Engineers Subject

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Webpage of the subject: physics.bme.hu/BMETE11MX22_kov?language=en

Instructors:



Marian Wittmann



Krisztián Szász

Contacts on the webpage

3 measurements:

Mechanics - standing waves on stretched string → Project: at home

Thermodynamics - calorimetry → Project: at home

Optics - focal length of lens, polarization,
Michelson interferometer → On site measurement

Schedule of the semester

This introduction: summary of the rules file found on the webpage

At the beginning of every occasion: **Test in Moodle**

Multiple-choice questions
Simple calculations

● 14:15-14:45

Mechanics and thermodynamics project: **at home**

Optics measurement: **in the laboratory**



or



● In order to prepare for it, read the laboratory notes

Pen/pencil, calculator, blank paper only

Individual

25 points at most, at least 10 points

After the test: the project/measurement starts **Accomplished by groups**

A group contains 2 students; in Moodle

Building F3,

Projects

Optics measurement

2nd floor

Available on Wednesday for
everybody from 15:00 in Moodle

Starts after completing the test

Simulations

Real measurements

One week for preparing the report;
single pdf per group; upload in Moodle

Answer sheet has to be filled; on site

Instructor will collect it; take a photo

Preparing homework within one week;

single pdf per group; upload in Moodle

Due date: one week deadline

Cutoff date: additional one week

Once a group can late one week without point loss

After the test: the project/measurement starts **Accomplished by groups**

A group contains 2 students; in Moodle

Projects

Reports:

All data with units

Screenshots

Plots

Evaluation

Short discussion

Optics measurement

Homework:

Only the evaluation, plot, short discussion

If a measurement is not successful, it must be repeated during the repetition occasion

25 points at most, at least 10 points

Due date: one week deadline

Cutoff date: additional one week

Once a group can late one week without point loss

Significant figures

One late allowed for one project/ measurement

Late again: 10 points subtraction per week

**In case of copying, the project report or homework cannot be accepted
and the subject cannot be completed**

Test, project, measurement can be repeated at the end of the semester (repetition)
but only one from the three topics

Insufficient result, less than 10 point

Improve the result (overwrites the previous one)

Grading scheme: in the rules file

If it is needed, consultation can be held upon request;
communication via email (Neptun)

Accident prevention and fire protection

In case of accident, the instructor must be informed immediately. There are no dangerous measurements, but

- take care of yourself and watch out for the others and the equipments;
- do not eat in the laboratory;
- do not let the laser light get into the eyes;
- wall socket: 230 V, do not put banana plug into it (in this case at the other end of the plug 230 V could be obtained) banana plug can be used only for low voltages, in case of electric shock: do not touch that person, as soon as possible turn off the main power switch belonging to the workplace (one workplace means one room, red one turns off, green turns on) and we should call the ambulance, in serious shock we have to give first aid;
- always put back the seat under the desk if you do not sit during the measurement;
- in case of fire: turn off the power, use fire extinguisher, call the fire fighters, escape the room;
- if an equipment/device goes bad (or does not work properly) it should be told the instructor immediately, do not connect an ammeter directly to a voltage supply (short circuited) this breaks the ammeter and /or the safety fuse;
- no break will be held during the measurement (however students can take break if they want for a short time but the exercise must be finished by 17:15). In other cases the corresponding section of the TVSZ (Regulation of Studies and Exams) has to be referred.

Significant figures

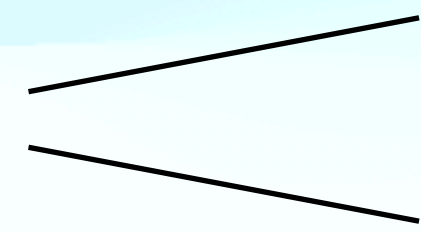
How many numbers have to be kept in the result?

non zero digits: 67; 123.5
2 4

trapped zeros between significant figures: 206; 15.023
3 5

leading zeros are not: 0.013
2

1200



4 significant f. (resolution allows)

2 significant f. (rounding)



ambiguous

to avoid it: scientific notation:

$$1.2 \cdot 10^3$$

exact numbers, constants: 4 apples (4.00000...)

$\pi = 3.141592\dots$ infinit number of sign. f.

Significant figures

Addition, subtraction

$$2,0 + 0,36 + 3,125 = 5,485 \approx 5,5$$

\downarrow \downarrow \downarrow \downarrow
1 2 3 least number of decimals

$$13 + 0,125 + 4,1 = 17,225 \approx 17$$

\downarrow \downarrow \downarrow
0 3 1

Multiplication, division

$$0,0032 \cdot 356,3 = 1,14016 \approx 1,1$$

\downarrow \downarrow \downarrow
2 4 least number of significant figures

Significant figures

Round the final result only, in the intermediate calculations keep practical number of decimals to avoid rounding error.

Heating water:

$$V \cdot I \cdot t = c \cdot m \cdot (T_1 - T_0) \rightarrow c = \frac{V I t}{m (T_1 - T_0)} = 4221,1162 \frac{\text{J}}{\text{kg} \cdot \text{K}} \approx 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$

$$V = 50,0 \text{ V} \rightarrow 3$$

$$I = 2,1 \text{ A} \rightarrow 2$$

$$t = 198,3 \text{ s} \rightarrow 4$$

$$m = 107 \text{ g} \rightarrow 3$$

$$T_1 = 20,1 \text{ }^\circ\text{C} \rightarrow 3$$

$$T_2 = 66,2 \text{ }^\circ\text{C} \rightarrow 3$$

intermediate: $V I t = 20821,5 \text{ J} \approx 21000 \text{ J}$

$$m (T_1 - T_0) = 4,9327 \text{ kg} \cdot \text{K} \approx 4,93 \text{ kg} \cdot \text{K}$$

$$c = \frac{21000}{4,93} = 4259,634888 \approx 4260 \frac{\text{J}}{\text{kg} \cdot \text{K}} \approx$$

$$c = \frac{20822}{4,933} = 4220,9608 \frac{\text{J}}{\text{kg} \cdot \text{K}} \approx \begin{matrix} \text{overall} \\ \text{rounding} \end{matrix} \approx 4300 \frac{\text{J}}{\text{kg} \cdot \text{K}} \approx 4200 \frac{\text{J}}{\text{kg} \cdot \text{K}}$$