Phys 124 – Spring 2024

Freshman Project

A course for:

- Learning research methodology
- Practice carrying out research
- Learn tools to present the results of research

Syllabus

All course information available at:

http://www.fen.bilkent.edu.tr/~yalabik/ders/phys_124_24/

About the course:

- This course intends to impart to the student, knowledge and capabilities associated with basic research methods and tools needed to carry out research in Physics. The course will involve 1 hour of classroom instruction or 2 hours of labwork per week in which the student will be exposed to such subjects as literature and citation search through indices, planning and carrying out research procedures, research ethics, use of scientific computer tools for statistical analysis, report construction and presentation.
- The course will proceed in relation with a project on a specific topic in physics or a closely related area. The course will expose students to research through projects that require no prior knowledge beyond the high school level.
- Teaching goals include practicing critical thinking, analyzing cause and effect relationships, planning controlled experiments, as well as gaining familiarity with useful skills such as literature search and scientific document preparation.

Syllabus

Homework:

- The project activity and classroom topics will generate regular assignments aiming to provide sufficient practice of the tools thought during class.

Attendance requirement

- If a student misses more than 6 hours of class, (s)he will need to compensate this by completing assignments which will take much longer time to do, or the grade will be an F.

Grading:

- The grading will be based on the progress of the student's research project, which will be assessed regularly during the semester through the reports and presentation material that will have to be prepared. Students will also be graded on the presentation of their project at the end of the semester.

Homework performance and attendance will also affect the final grade.

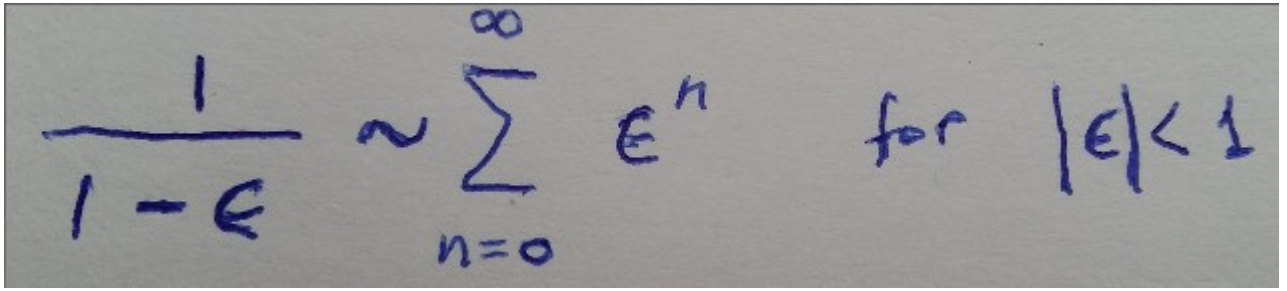
Syllabus - grading

• Literature search homework	10%	Due Wednesday Feb. 14
• Project proposal	10%	Due Wednesday Feb. 21
• LaTex homework	10%	Due Wednesday Mar. 13
• Project progress report	10%	Due Wednesday Mar. 20
• Numerical modeling homework 1	10%	Due Wednesday Apr. 3
• Numerical modeling homework 2	10%	Due Wednesday Apr. 17
• Project report	10%	Due Wednesday Apr. 24
• Project presentation material	10%	Due Wednesday May 8
• Project presentation	20%	

Software we will use

Proprietary	Public domain
MS-Windows	Linux
python	python
MS-Office	Openoffice
– Word	– Writer
– Excel	– Calc
– Powerpoint	– Impress
	LaTex
	Gnuplot

LaTex

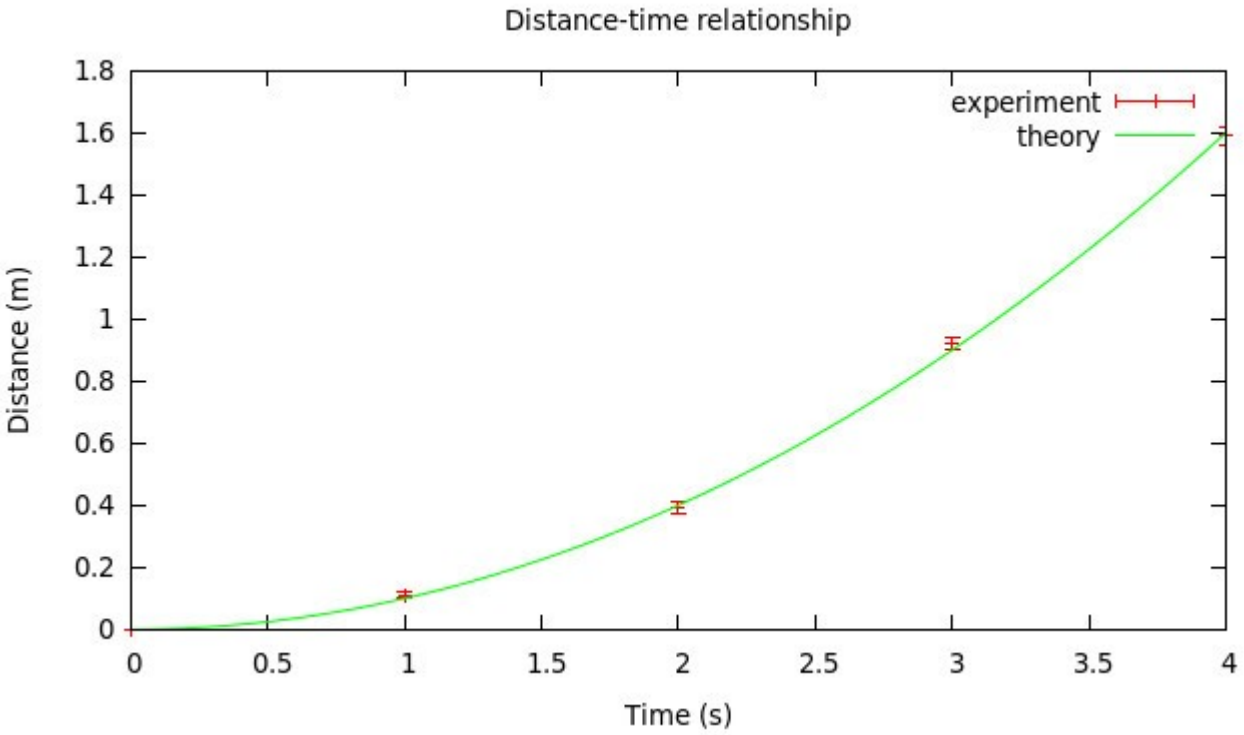


\frac{1}{1-\epsilon} \sim\sum_{n=0}^{\infty} \epsilon^n\mbox{ for } |\epsilon | < 1

$$\frac{1}{1-\epsilon} \sim \sum_{n=0}^{\infty} \epsilon^n \text{ for } |\epsilon| < 1$$

gnuplot

time (sec)	distance (m)	error
0	0	0
1	0.11	0.01
2	0.39	0.02
3	0.92	0.02
4	1.59	0.03




```
set title "Distance-time relationship"

set xlabel "Time (s)"

set ylabel "Distance (m)"

plot "data" w errorbars title 'experiment' , 0.1*x*x title 'theory'
```

About projects

Experimental:

Tools:

Smart phone: magnetometer, accelerometer, light and color measurements

Lab equipment: Freshman lab

Computers

- Acceleration profiles of elevators in Bilkent
- Variable star measurements
- Correlations between (phase of moon - weather - earthquakes - …)
- Measurement of temperature of lamp filament

About projects

Experimental:

- Your project report must contain a measurement, designed around the test of a hypothesis
- The measurement must be displayed as a graph - the measured value vs adjusted parameter(s)
- You must demonstrate your experiment to the assistant
- A movie will be nice (i.e. extra credit)

What next?

- **Jan. 31** Introduction, description of work to be carried out

  [Discussion of possible project topics] Discussion of available personal and university resources

- **Feb. 7** Literature search

  Planning a project

  Hypothesis, analysis/experiment, evaluation

  Class discussions on all of the project topics

- **Feb. 14** Introduction to Latex:

  LaTex examples

  Literature search homework due

- **Feb. 21** More Latex

  Project proposal due