Introduction to Physics Lab

Fall 2021-22

Department of Physics

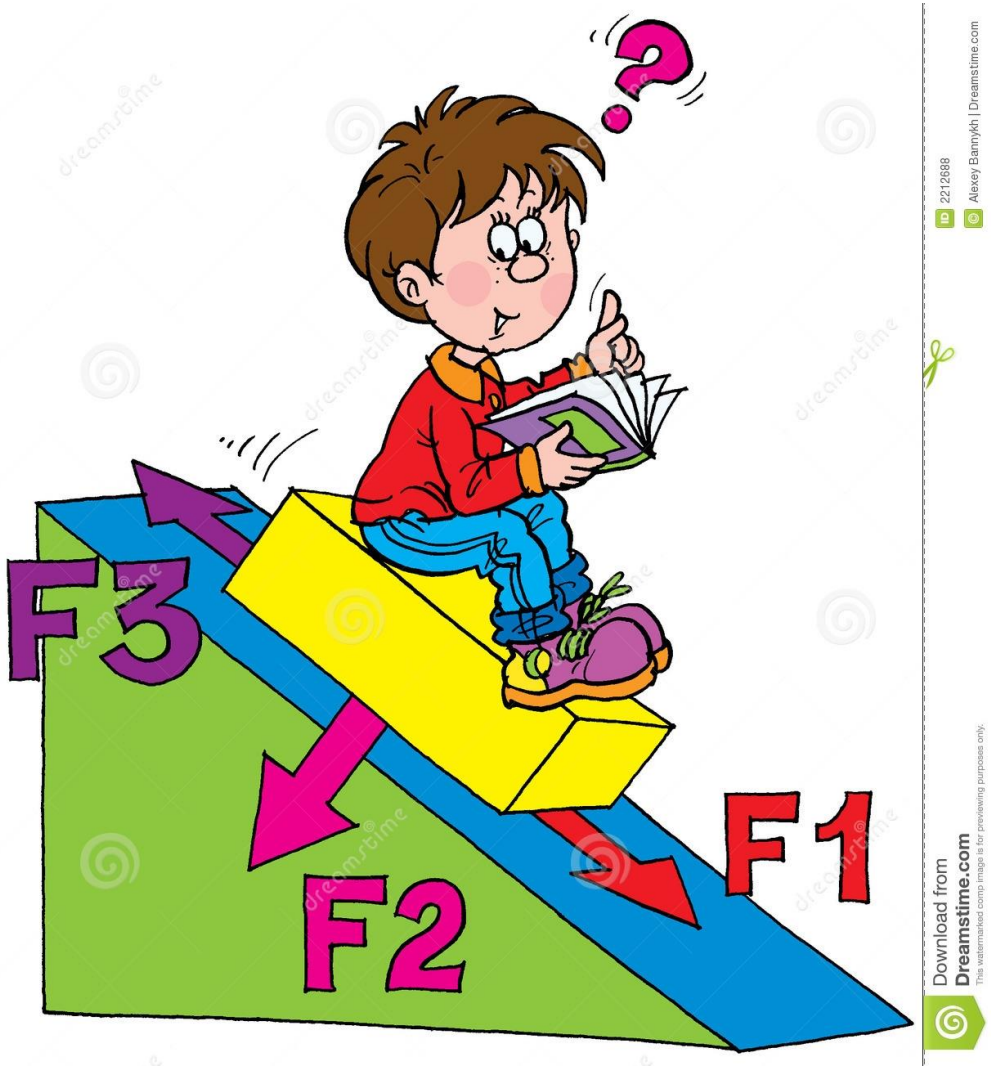
American International University-Bangladesh

When We Study Physics from Theory Class/Book:

We apply our imagination power to understand.

Still we have many questions:

- ❑Is it real?
- ❑How is it possible?
- ❑How it works?
- ❑Can we do it?



Study of Physics in Laboratory:

We can say:

✓Yes, it’s real.
✓Yes, it’s possible and it works.
✓Yes, we can do it.

It’s a fun!

Image Source: https://onlineprograms.education.uiowa.edu/wp-content/uploads/hero-mobile-stem-v1.jpg

Course Outline for Physics 1 Lab

- **Course Code:** PHY 1102
- **Course Title:** Physics 1 Lab
- **Class Duration:** 3 hours per week.

Course Outcomes (CO)

At the end of this course, students will be able to:

CO 1	**Understand some basic laws and concepts of Physics**
CO 2	**Design experimental setup**
CO 3	**Analyze data to obtain result**
CO 4	**Draw graphs in Excel and extract results from them**
CO 5	**Evaluate the results of an experiment**

Topics to be covered in Laboratory Classes: Up to Midterm

Time Frame	Topics	Specific Outcomes	Suggested Activities
WEEK 1	**Introduction to Physics Lab**	▪ Purpose of Physics Lab ▪ Understand course outline ▪ Learn the way to conduct an experiment and write a good lab report.	• Discussion on basics of Physics Lab • Demonstration of report writing for Physics Labs • Demonstration of graph plotting in Excel
WEEK 2	**Acceleration due to gravity**	Estimate the value of acceleration due to gravity in the lab	• Understand the relation between time period and length of a simple pendulum, way to find the regression line by the liner least square regression method. • Construct a simple pendulum and determine its time periods for different lengths. • Apply the linear least square method to estimate the value of acceleration due to gravity, also compare the result with the result of graph in Excel.
WEEK 3	**Newton's Second Law of Motion**	Verification of Newton's second law of motion	• Understand Newton's Second Law • Construct an Atwood Machine • Establish the relationship between mass difference and acceleration by plotting a graph in Excel
WEEK 4	**Projectile Motion, Collision**	Study of the projectile motion and collision of a ball.	• Understand the theory of Projectile motion and collision • Construct a simple set up to observe projectile motion and collision • Determine different quantities related with projectile motion and

Midterm Assessment:

Week 5 & Week 6

Topics to be covered in Laboratory Classes: During Final Term

Time Frame	Topics	Specific Outcomes	Suggested Activities
WEEK 7	Ohm's law, Equivalent Resistance for Series and Parallel Combinations	To determine unknown resistances by applying Ohm's law	• Understand how unknown resistance can be determined from the graph of Ohm's law • Construct simple circuit with one resistance and two resistances (series and parallel combinations) to take readings for current and voltage • Plot graphs in Excel to determine unknown resistances
WEEK 8	Temperature Coefficient of Resistance of metals	To determine the temperature coefficient of resistance of the material of a conducting wire	• To understand the concept of temperature coefficient of resistance of metals, design a simple circuit to see the effect of temperature on resistance for a conducting wire, • Analyzing the data to calculate the temperature coefficient of resistance of the material of the wire.
WEEK 9	RC circuit	To determine the RC time constant of a RC circuit	• Understand the charging and discharging of a capacitor, concept of time constant of a RC circuit, • Construct a RC circuit, observe the charging and discharging of a capacitor and plot them in graphs, determine the value of RC time constant from another graph.

Week 10: Review Class

Week 11 & Week 12: Final Term Assessment

Assessment Pattern: During Lab Days

❑ **Attendance and Performance:**

- Students have to come to the online lab on time, their prelab work and lab works have to perform according to the manuals.
- Total 10 marks for each term for this part.

❑ **Lab Report:**

- Students have to submit lab reports as groups on the lab days.
- Each lab report contains 15 marks and total 45 marks for each term.

Assessment Pattern: Mid/Final

- **Viva**

- In the lab exam week, individual viva will be taken based on lab reports and outcomes of the labs.
- The marks for this part is 25 for each term.
- The assessment will be based on student's individual ability to understand the theory and experiment procedure related with the labs, development of analyzing and evaluation power, creativity to solve new problems.

- **Mid/Final Assessment:**

- As the term exam one MCQ based assessment will be taken.
- The marks for this part is 20 for each term.
- The assessment will be based on student's individual ability to remember, understand and apply the theory and experimental knowledge related with the labs, development of analyzing and evaluation power.

Mark Distribution: Summary

Marking system For Laboratory Classes (Midterm and Final term)	
Attendance and Performance	10%
Lab Report	45%
Lab Viva	25%
Mid/Final Term Assessment	20%
Total	100%
Final Grade/ Grand Total	
Midterm	40%
Final Term	60%
Grand Total	100%

Textbook/References:

- **Practical Physics-** Dr. Giasuddin Ahmed and Md Shahabuddin.
- **Fundamentals of Physics** (10^{th} edition)- Halliday, Resnick and Walker.
- **Course Outline, Lab Manuals, Report Templates**, etc. (will be uploaded in the Microsoft Teams and AIUB portal).

To Buy Books:

AIUB BOOK STORE
Cell-01720290329, (WhatsApp, Viber)
Email- aiubbookstore@gmail.com.

Lab Activities (total 3 hours per class)

- **Lab Preparation (10 minutes):**
  - Students must come to the class on time, class attendance will be taken.
- **Lecture on Theory (30 minutes):**
  - The objective, theory and apparatus of the experiment will be discussed.
- **Lecture Video on Procedure (15 minutes):**
  - Students will watch a lecture video and try to understand the procedure of the experiment.
- **Experimental Work (90 to 100 minutes):**
  - A sample data will be provided to students and teacher will clarify every part of it.
  - Students will do all the calculations, draw graphs on excel and complete the result part.
- **Post Lab Discussion (15 to 20 minutes):**
  - Teacher will summarize the total lab work and have a discussion with the students related with the questions given in the outcomes part of the lab manual.

Report Submission:

After completing the lab students will upload their lab reports as groups in teams in the same day.

Lab Report: Components

- Cover Page
- Theory
- Apparatus
- Procedure
- Experimental Data
- Analysis and Calculations
- Result
- Discussion

A template file for the Lab Report will be uploaded in teams.

Group Formation

- Total 8 groups for 40 students.
- Each group will contain maximum 5 members.
- Students could form their own group or teacher may help them to form the group.

No Makeup for the Labs

Way to Draw Graphs in Excel

Resource: https://www.youtube.com/watch?v=HJsWXRm0mlU