PH 220 Introductory Physics I: Laboratory Syllabus

Winter 2020 ∘ Northern Michigan University

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Begin subject line with "*PH 220-Lab: "*

Office Hours: Tu: 14−15:50 & R: 13:30−15:20 in *WS 2513*. Other times by appointment

Class Meetings All lab sections meet in WS 2607
{-02, CRN 10369} Wed 13:00-14:50 ; {-03, CRN 10552} W 16:00-17:50

Webpage: http://physics.nmu.edu/~pmengyan ; Educat [lab only]

Required Text: The Physics department will provide documentation for each lab.
There is no additional required text for lab.

Required Materials:
NMU Physics will provide one copy of each of the required printed lab material to the student. Students will provide their own copy of the textbook, paper, pencil, eraser, and calculator (NOT a cell phone or laptop, but an *actual* calculator). The student's NMU issued laptop will also be required for many of the lab activities.

Class Meetings:
Laboratory sections will meet at each student's officially scheduled place and time. Students are *only* permitted to regularly attend sections for which they are *officially* registered. Make-ups for missed labs are *not* possible (see *attendance* section below for more detail on the policy).
Food or drinks in any form (including chewing tobacco, gum, etc) and cell phone (or any other non-approved electronic gizmo) usage are *not* permitted in the lab room.

Grading:

40%	−	Quizzes
60%	−	Lab work (e.g. charts, graphs, participation, post-lab questions, recaps, etc)
100%	−	*Total Lab Grade Reported to Lecture*

Laboratory (lab work):
The laboratory portion will consist of working through the interactive exercises during the class time, which will include activities such as data collection, analysis and answering questions within each exercise. Overall topics include classical mechanics (motion, forces, work, energy, momentum, periodic motion). Performance in the laboratory portion is evaluated via in-class [instructor] observation and submitted lab work. The student must participate in the data collection portion of a lab in order to earn credit for work submitted related to that exercise.
Lab work will generally be due at the start time of the next scheduled lab meeting. Any changes to the due date and time for an assignment will be discussed in class. *Late work is not accepted*.

Lab Recaps:
Short, typed statement discussing the highlights of the relevant laboratory exercise. If applicable, students are required to use the format provided by the instructor. Recaps that are hand written (i.e. not typed) or that follow any format other than what the instructor specifies will not be accepted under any circumstances. Equations and diagrams *may* be neatly written in by hand.

Quizzes:
May be administered in the beginning of each class and include material from the previous lab.

Participation:
Punctuality (in your seat and ready to begin by the scheduled start time), not leaving early, being on-task and maintaining a respectful attitude are all examples of what may contribute to the participation grade. Completing physics education research or department assessments (e.g.: general pre-test, post-test or other surveys) may also count toward your participation grade.
Full credit for participation is earned by making a serious effort in completing the assigned activities regardless of the *accuracy* of the particular responses. Participation points may not be earned if equipment is utilized in any form that is not related to the prescribed exercise, fail to take part in group work or are otherwise not on task. Violations of the lab and general class rules may result in dismissal for the class period, reduction in participation grade, forfeiture of any submitted work remaining incomplete due to the dismissal and, if necessary, reported to the appropriate authorities.

Attendance:
Attendance contributes directly to the participation grade as if one is absent one is not capable of participating in a given activity. Absences will be excused for officially sanctioned university events, illness (documentation may be required), court appearances (plaintiff, defendant, witness, juror -- documentation is required), family emergencies (at the discretion of the instructor and may require appropriate documentation). If something occurs that you feel should be grounds for being excused it is your responsibility to contact your instructor, in writing, PRIOR to the absence (if possible, or as soon as possible after the absence) to discuss the situation. Excused absences for situations beyond the purview of NMU policy are at sole discretion of the instructor, will be evaluated confidentially, on a case-by-case basis and confirmed in writing.
An excused absence does NOT necessarily excuse you from completing the work. Arrangements for a planned excused absence, if possible, should be finalized (with written confirmation between the student and instructor) no later than the Friday before the week for which the absence will occur. Otherwise, establish contact with the instructor as soon as reasonably possible.

ADA Statement
In compliance with the ADA and university policy
"If you have a need for disability-related accommodations or services, please inform the Coordinator of Disability Services in the Dean of Students Office at 2001 C. B. Hedgcock Building (227-1737 or disserv@nmu.edu). Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines."

Religious Holiday
Pursuant to university policy, a student who intends to observe a religious holy day should make that intention known, in writing, to the instructor prior to an absence. A student who is absent from a class, exam or exercise for the observance of a religious holy day shall be allowed to complete an assignment or exam scheduled for that day within a reasonable time around that absence.

Academic Integrity
Section 2.3.1 of the NMU Student Handbook discusses scholastic dishonesty; all of which will be upheld in all aspects of this course. Academic dishonesty will not be tolerated.
Link to student handbook https://www.nmu.edu/policies?p=1070&type=Policy

Appropriate behavior:
Students are expected to behave in a respectful, considerate and courteous fashion in any activity related to this course. Rude, disrespectful or disruptive behavior will *never* be tolerated.

Physics 220 Laboratory Schedule

Winter ◦ 2020

Week	Experiment	Description
1	Graphing	Data reduction and graphical analysis
2	Vector addition	Addition of 2-D vectors with analytic and graphical methods; testing the addition with an experiment using a force table
3	Constant acceleration	Experimentally determining `g'. Computer aided graphing is introduced.
4	Projectile motion	Test your skills and understanding of 2-D kinematics by predicting and measuring parameters for an object in flight
5	Force and acceleration	Test Newton's 2nd law (relationship between force and time-varying momentum)
6	Friction	Measuring coefficients of friction
7	Uniform circular motion	Measuring the force required for a rotating bob to maintain a uniform circular path
8	Conservation of energy	"Peg and Pendulum": Test relationship of gravitational potential energy and kinetic energy in a system where work done by non-conservative forces is negligible
9	Impulse and momentum	Collisions to directly test the impulse-momentum theorem
10	Conservation of momentum	Experimenting with collisions
11	Torque balancing	Studying rotational equilibrium
12	Moment of inertia	Experimentally determine the moment of inertia of a system
13	Simple harmonic motion	Studying periodic motion with a pendulum and a mass-spring systems
14	Archimedes' principle	Experimentally determine density of objects

Notable dates:
13 Jan 20: First official day of class
04 Mar 20: No class (mid-sem break)
25 Apr 20: Last day of class

Wk #		Start Date	WK #		Start Date
1	→	13 / Jan / 20	8	→	09 / Mar / 20
2	→	20 / Jan / 20	9	→	16 / Mar / 20
3	→	27 / Jan / 20	10	→	23 / Mar / 20
4	→	03 / Feb / 20	11	→	30 / Mar / 20
5	→	10 / Feb / 20	12	→	06 / Apr / 20
6	→	17 / Feb / 20	13	→	13 / Apr / 20
7	→	24 / Feb / 20	14	→	20 / Apr / 20

General learning outcomes (main areas)

In general, the learning outcomes for and experience in this undergraduate physics laboratory are consistent with the standards set by the American Association of Physics Teachers (AAPT), that is

- Constructing knowledge
    - Through laboratory work, students should gain the awareness that they are able to do science
    - A successful student can collect, analyze and interpret real measured data in an ethical manner as a responsible scientist and draw meaningful conclusions from personal observations of the physical world
- Modeling
    - Modeling entails developing an abstract representation of a real system under study in the laboratory providing a link between theory and experiment. These may be qualitative or quantitative (or both) and contribute to understanding a system or phenomenon.
    - A successful student can
        - develop and apply models to represent physical systems including their measurement devices
        - implement the models as appropriate
        - use models to predict the outcomes of experiments
        - interpret their laboratory results in the context of models they have developed (Including, e.g.: identifying a model's limitations, the model's basic assumptions and impact the assumptions have; considerations of uncertainties in measurements and the limitations of the measurement devices)
- Technical and practical laboratory skills
    - Students will be exposed to a range of standard laboratory measurements, learn to use equipment and be cognizant of the device limitations
    - A successful student can
        - perform measurements using standard equipment and accurately record their measurements and observations
        - understand the limitations of the measurement devices and how to choose the appropriate equipment for a particular measurement
- Analyzing and visualizing data
    - Work with observations
    - A successful student can
        - apply methods (e.g. statistical, linear, non-linear) to analyze data and critically interpret the validity and limitations of the data displayed
        - choose appropriate data reduction and plotting methods to represent and fit data then extract physical quantities from fit parameters
        - quantify uncertainties in the data and propagate these through calculations
        - compare experimental results to models or simulations
- Communicate technical information
    - Present results and ideas with reasoned arguments supported by experimental evidence and utilizing appropriate and authentic written and verbal forms
    - A successful student can
        - present reasoned arguments supported by experimental evidence (including e.g. plots, tables, results with uncertainties, diagrams, discussion based on observations, etc)
- Teamwork and collaboration skills