Syllabus

Physics 121 Lab— Fall 2019

Our freshman laboratory program aspires to provide students with engaging and rewarding interactions with the physics of the world around them. The weekly laboratories address a cross-section of the concepts introduced in the lecture part of the course. This lab introduces the student to techniques for obtaining and analyzing experimental observations using diverse methods and equipment.

The sessions are led by a Teaching Assistant (TA), who is usually a physics graduate student. In general, students are asked to report their activities and results clearly and concisely in formats ranging from "worksheets" to a formal Lab report write-up. The time spent outside of lab on preparation, data analysis, and presentation will vary somewhat, but an average of no more than 3 hours of outside work per lab is encouraged.
Some guidelines to remember throughout the semester:

1. Make sure always to get your raw data signed and initialed by your TA before leaving the lab session.

2. Reports will be graded according to the rubric given below.

3. Punctuality in attendance and completion of assignments are critical.

4. Rotation of individual roles in a team effort to ensure everyone's participation in the exercises.

5. Approaching all issues with professional courtesy and respecting the efforts, opinions, and property of others.

6. **Disruptive behavior**, including horseplay and reckless use of equipment, will NOT be tolerated!

7. **Academic honesty.**
   New Mexico Techs applicable policy regarding academic honesty is expressed in the NMT Undergraduate Catalog, and it will be strictly enforced. You are responsible for knowing, understanding, and following this policy.

   Laboratory exercises are a group effort, and discussing the material with each other is encouraged. Data obtained during the lab session is expected to be the same within each group (tables, graphs, etc.). However, your written assignment must be your own work; any help received must be acknowledged, and proper citation of the utilized sources must be included. Plagiarism is not tolerated. Any suspicion of a violation of the letter or intent of the NMT policy will be reported to the Lab Director, who will determine the appropriate charges to bring to the office of the Associate Vice President for Academic Affairs.

   In general, obtaining answers that in any way bypass the need to think about the assignment is a violation of the academic honesty policy, and can have serious consequences. If in doubt, please ask your instructor before submitting any work as your own.

NMT Services and Polices

Reasonable accommodations. New Mexico Tech is committed to protecting the rights of individuals with disabilities. Qualified individuals who require reasonable accommodations are invited to make their needs known to the Office of Counseling and Disability Services (OCDS) as soon as possible. To schedule an appointment, please call 835-6619.

Counseling services. New Mexico Tech offers mental health and substance abuse counseling through the Office of Counseling and Disability Services. The confidential services are provided free of charge by licensed professionals. To schedule an appointment, please call 835-6619.

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Respect Statement. New Mexico Tech supports freedom of expression within the parameters of a respectful learning environment. As stated in the New Mexico Tech Guide to Conduct and Citizenship: New Mexico Techs primary purpose is education, which includes teaching, research, discussion, learning, and service. An atmosphere of free and open inquiry is essential to the pursuit of education. Tech seeks to protect academic freedom and build on individual responsibility to create and maintain an academic atmosphere that is a purposeful, just, open, disciplined, and caring community.

List of Laboratory Exercises

Week 1. No Lab— first Week.

Week 2. Vector Addition of Forces— Vector addition is demonstrated using static forces. A force table is used for the experimental demonstration. Next, the static equilibrium is explored both graphically and mathematically.

Week 3. Kinematics— In this lab, we study the description of a particle's motion. The objective is to recognize constant velocity and various types of accelerated motion from looking at the track left by a moving particle.

Week 4. Projectile Motion— In this lab, projectile motion is studied with emphasis on the vectorial aspect of the equations of motion, which are decomposed into Cartesian components for their analysis. The range of a projectile is measured for different launch configurations and then compared to the values predicted by theory.

Weeks 5,6. Newton's Laws— This lab spans 2 weeks. It demonstrates Newton's second and third laws of motion. The relevant variables velocity, acceleration, and force are measured using a computerized system for data acquisition. During the first week, measurements of acceleration and force are performed on air an track; during the second, we explore the Atwood's machine and static and dynamic friction coefficients.

Week 7. Conservation of Energy— In this laboratory exercise, conservation of energy is used to predict the exit speed of a car sliding on a convoluted ramp. The actual exit speed is measured using a photogate and compared to the theoretical prediction.

Week 8. Binary System— In this lab, we study the conservation of energy and momentum in a binary system that allows for orbital motion. The orbits of two spring-coupled masses are examined in the reference frame of their center of mass.

Week 9. Collisions in 1-D and 2-D— In this lab, momentum and energy conservation are investigated. Specifically, we examine elastic collisions in one and two dimensions, as well as partially and totally inelastic collisions in one dimension.

One-dimensional collisions are set up using an air track, while two-dimensional collisions are set up on an air table.

Week 10. Inelastic Collisions— In this lab, conservation of momentum is investigated in two kinds of inelastic collisions: the ballistic pendulum and the angular collision.

Week 11. Torque and Moment of Inertia— In this lab, the relationship between torque and Force is examined and then its connection to angular acceleration is used to determine the moment of inertia of a Disk-like object.

Week 12. Rolling Without Slipping— In this lab, the translational and rotational motion of an object rolling down a ramp are analyzed using both conservation of energy and torque/acceleration approaches.

The observations are used to evaluate the moment of inertia about the axis of rotation predicted by each approach. The results are then compared to values obtained directly from the definition of the moment of inertia for each of the rolling objects.

Week 13. Angular Momentum— In this lab, the conservation of angular momentum is investigated during the following situations: orbital motion, internal changes in the moment of inertia, changes in orientation of the axis of rotation.

Week 14. No Lab— Thanksgivings Week.

Week 16. Harmonic Oscillators— In this lab, the behavior of harmonic oscillators is investigated. The classic mass-spring system is studied under forced and unforced conditions. Simple and conical pendulums are also studied in this lab.

Week 17. No Lab— Last Week.

Grading Rubric: 121 Lab

Total /100

	Expectations	Deductions	Points Earned
Presentation	• Report is written in a consistent tense, in complete sentences, with proper grammar, punctuation, and spelling. It acknowledges any help received and cites any external source used in its preparation*. • All quantities have units.		/10
Introduction	• The purpose of the lab - what is the lab about and what goals are you trying to accomplish?		/5
Methods	• A brief description of the experiments and procedures.		/10
Analysis	• Sample calculations for each equation used in the analysis as well as calculations for error analysis. • Results are consisting with data collected*. • Answer the questions asked in the lab manual, including any plots.		/35
Discussion	• Discuss your results - did they reflect your purpose and goals from your introduction? • Include a numerical discussion of results, including error analysis		/10
Raw Data*	• Raw data sheet is attached to lab report, has signature, and acknowledges team members; *n*ote: data from the raw data sheet must be used in calculations.		/10
Attendance & Participation*	• Student attended class and actively collaborated within the team during the lab experiment.		/20