FUNDAMENTAL MECHANICS LABORATORY

Phys 131L Fall 2020

Instructor:	Professor David Collins
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Office Hours:	M 11am - noon, T 10 – 11am, W 3 – 4pm, R 2 – 3pm, F 11am - noon
Class Meetings:	Thursday 8:00 – 9:45am (section 001), Thursday 10:00 – 11:45am (section 002), Wubben/Science 214
Course Website:	http://www.coloradomesa.edu/~dacollin/teaching/2020Fall/Phys131L/index.html
Prerequisites:	Phys 131 (co-requisite)

Overview

Physics is an experimental science; that is, the nature and validity of the theoretical framework that physicists use is informed by the outcomes of repeatable experiments.

Phys 131L is the laboratory accompanying Phys 131. In this course you will conduct experiments and make observations on various physical systems. There are two objectives in this component of the course:

1. gain hands-on experience with physical phenomena and
2. understand the relationship between experimental observations and the corresponding theory.

Course Structure

Class will meet once during each of the weeks listed in the schedule on the last page. During each meeting you will be given specific laboratory activities, tasks and assignments. Some of the laboratories consist of **traditional experiments;** in these you will set up an apparatus, gather and analyze data and reach conclusions about the underlying physics based on your analysis. In other laboratories you will conduct **qualitative, computational or "thought" experiments;** these are accompanied by a worksheet consisting of a series of questions that you will answer.

COVID adjustments: The COVID room capacity will only allow for half of the class to meet at any one time. Thus the class will be divided into two groups, each of which will alternate between meeting in person and online. All groups will eventually complete all exercises. Online meetings will be hosted using Zoom.

Assignments and Work Expectations

1. **Pre-lab Exercises:** There will be a pre-lab exercise due one hour before the beginning of every laboratory meeting (except the first meeting). The pre-lab exercise will cover issues that arise in that laboratory.

2. **Lab Reports/Packets:** For the laboratories consisting of the traditional or computational experiments you will be required to turn in:

   a) Lab notes containing data, graphs and any analysis and conclusions. These must be well-organized and intelligible to the instructor; notes in the margins of the lab packets are unacceptable.

   b) A brief, informal report describing the aims, methods and results of the experiment. This may be written in bullet point form. Guidelines will be provided in lab packets.

   For the laboratories consisting of qualitative or "thought" experiments you will be required to turn in:

   a) A completed worksheet as well as any essential data, graphs and analysis. It is acceptable to write your answers on the worksheet.

All work must be turned in via D2L, which will have a drop box for each assignment. Each piece of work that you turn in must be a single file, preferably in pdf or word format. If the document contains images they must be legible and oriented in normal portrait mode.

An undergraduate student should expect to spend on a minimum of one hour outside the classroom for every two hours in laboratory. The outside hours may vary depending on the number of credit hours or type of course. More details are available from the faculty member or department office and in CMU's Curriculum Policies and Procedures Manual.

Attendance

The reduced class capacity has resulted in the following attendance requirements.

a) **In-person laboratory exercises:** You are expected to attend all in person class meetings for your group. You will be required to remain in the lab room until you have finished all data analysis. If you finish early, you need to show your work to the instructor prior to leaving.

b) **Online laboratory exercises:** During any online exercise in which both groups are working simultaneously on the same exercise you are expected to join the Zoom session and remain in the session until you have satisfied the instructor that you have completed at least half of the lab exercise.

c) **Absences:** If you are absent from an in-person lab you must explain your absence to the instructor, provide documentation to explain it, and, if this is satisfactory, an arrangement will be made to make up the lab or account for the missing grade.

Grades

Each week's assignment will be graded out of 20 points. Of these 4 points will be assigned to the pre-lab exercise and the remaining 16 to the lab report/packet. These will be graded according to:

1. **Pre-lab Exercises:** Checked for completeness and correctness. A complete solution will include an explanation describing all physics and mathematics needed to understand the answers.

2. **Lab Reports/Packets:** In traditional or computational experiments, the lab report will be graded for completeness, correctness and organization. All important calculations, units and graph labels, etc,... must be present. In qualitative or "thought" experiments, the worksheet/packets will be graded for completeness and correctness.

You will only receive credit for the lab report/packet if you were present for the entire lab subject to the attendance policy above. The deadline for each assignment will be given during the relevant class meeting time.

Individual lab scores, excluding the single lowest lab score, will be added together and converted into a percentage score. The following percentages will guarantee letter grades:

90%	A
80%	B
70%	C
60%	D

Policies

1. The Tutorial Learning Center (TLC) is a *free* academic service for all CMU students. Tutors are available in Houston Hall 113 on a walk-in basis for many courses. More information is available at www.coloradomesa.edu/tutoring or 248-1392.

   In coordination with Educational Access Services, reasonable accommodations will be provided for qualified students with disabilities. Students must register with the EAS office to receive assistance. Please meet with the instructor the first week of class for information and/or contact Educational Access Services, directly by phone at 248-1801, or in person in Houston Hall, Suite 108.

   Helpful advice on student success can be found at:

   http://www.coloradomesa.edu/academics/documents/StudentSuccessatCMU_WCCC.pdf

2. **Attendance:** Attendance policies are described in the CMU catalog. You are expected to attend all the class meetings for your group.

   If you fail to attend an in-person lab, and do not make any arrangement with me or you cannot produce appropriate documentation, you will lose all credit for the lab activity portion of that lab. If you do not complete an online lab by the due date, you will lose all credit for the lab activity portion of that lab.

3. **Withdrawals:** There are several ways to drop this course. The deadline for dropping without penalty is **1 September 2020.** Please consult the CMU academic calendar and catalog for more details about adding and dropping courses.

4. **Academic Integrity:** You are expected to present your own work in assignments, exams and quizzes. Fabrication of data, plagiarism, and copying from anyone else, particularly in closed book exams, are serious violation of academic norms. CMU has extensive policies on these matters and penalties for infringement can be severe. For more details, consult the academic integrity policies in the CMU catalog.

Student Learning Outcomes (Course)

The learning outcomes for this course are as follows. A student who has taken this course will demonstrate the ability to:

1. Translate between verbal and mathematical descriptions of physical situations. Apply mathematical reasoning, using algebra, trigonometry and calculus, to analyze these situations.
2. Articulate the arguments, verbal and mathematical, used to analyze physical situations.
3. Represent physical processes graphically and describe given graphical representations in physical terms.
4. Use calculus to describe and analyze physical situations.
5. Use the mathematics of vectors, vector algebra, products of vectors and vector components to analyze physical situations.
6. Distinguish between and relate various linear and rotational kinematic quantities.
7. Apply Newton's First, Second and Third Laws to analyze the dynamics of physical situations involving linear and/or rotational motion.
8. Apply the concepts of energy, work, the conservation of energy, and the conservation of momentum to analyze the dynamics of physical situations involving linear and/or rotational motion.

Student Learning Outcomes (Essential Learning)

This course partly addresses two essential learning competencies.

Inquiry and Analysis Competency

Inquiry is a systematic process of exploring issues/objects/works through the collection and analysis of evidence that results in informed conclusions.

Student Learning Outcomes (SLOs): Students should be able to:

1. Select or Develop a Design Process
    a) Select or develop elements of the methodology or theoretical framework to solve problems in a given discipline.
2. Analyze or Interpret Evidence
    a) Examine evidence to identify patterns, differences, similarities, limitations, and/or implications related to the focus.
    b) Utilize multiple representations to interpret the data.
3. Draw Conclusions
    a) State a conclusion based on findings.

Quantitative Literacy Competency

Competency in quantitative literacy represents a student's ability to use quantifiable information and mathematical analysis to make connections and draw conclusions. Students with strong quantitative literacy skills understand and can create sophisticated arguments supported by quantitative evidence and can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc.).

Student Learning Outcomes (SLOs): Students should be able to:

1. Interpret Information
    a) Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
2. Represent information
    a) Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).

Guaranteed Transfer

The Colorado Commission on Higher Education has approved PHYS 131L for inclusion in the Guaranteed Transfer (GT) Pathways program in the GTSC1 category. For transferring students, successful completion with a minimum C- grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to http://highered.colorado.gov/Academics/Transfers/gtPathways/curriculum.html.

Content Criteria

This course should provide students with the opportunity to/Students should be able to:

a) Develop foundational knowledge in specific field(s) of science.
b) Develop an understanding of the nature and process of science.
c) Demonstrate the ability to use scientific methodologies.
d) Examine quantitative approaches to study natural phenomena.

The laboratory (either a combined lecture and laboratory, or a separate laboratory tied to a science lecture course) content of a GT Pathways science course (GT-SC1): Students should be able to:

a) Perform hands-on activities with demonstration and simulation components playing a secondary role.
b) Engage in inquiry-based activities.
c) Demonstrate the ability to use the scientific method.
d) Obtain and interpret data, and communicate the results of inquiry.
e) Demonstrate proper technique and safe practices.

Schedule

The following schedule is subject to modification.

Dates	
8/20	Lab 1: Motion in One Dimension (Group A).
8/27	Lab 1: Motion in One Dimension (Group B).
9/3	Lab 2: Free Fall Motion (Group A). Lab 3: Vectors (Group B).
9/10	Lab 2: Free Fall Motion (Group B). Lab 3: Vectors (Group A).
9/17	Lab 4: Projectile Motion (Group A). Lab 5: Introduction to Forces (Group B).
9/24	Lab 4: Projectile Motion (Group B). Lab 5: Introduction to Forces (Group A).
10/1	Lab 6: Newton's Second Law for a Single Object.
10/8	Lab 7: Newton's Second Law: Atwood's Machine
10/15	Lab 8: Conical Pendulum.
10/22	Lab 9: Work and Kinetic Energy.
10/29	Lab 10: Conservation of Energy.
11/5	Lab 11: Conservation of Momentum.
11/12	Lab 12: Equilibrium of a Rigid Body.
11/19	Lab 13: Rotational Dynamics.