General Education Course NMHED Recertification Form

This form has been designed to guide you through the recertification process for the UNM General Education course in question. Please fill out your contact information below, and then review the information about the course provided to us by the New Mexico Department of Higher Education *(*NMHED*). After this, you will be instructed to fill out three separate narratives concerning the course and its relevance to NMHED's area and skills associated with the course.*

UNM Course Information

Prefix	**PHYS**
Number	**1240L**
Name	**Algebra-based Physics II Lab**

Contact Information

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NMHED's Description and Outcomes for the Common Course

The description and student learning outcomes below come from NMHED's Common Course Catalog, *which can be found here, and is meant to designate standard descriptions and outcomes of courses registered as a NMHED* Common Course.

PHYS 1240L: Algebra-based Physics II Lab

A series of laboratory experiments associated with the material presented in PHYS 1240.

Student Learning Outcomes:

Upon completion of this course, the student will be able to:
1. Explain the scientific method.
2. Test ideas using modern laboratory equipment.
3. Estimate experimental uncertainties using statistical methods.
4. Use computers to analyze and report laboratory results.
5. Draw appropriate conclusions from quantitative scientific observations.
6. Accurately and clearly communicate the results of scientific experiments.

Institution-specific Student Learning Outcomes

Please add additional SLOs of the general education course to the ones provided by NMHED, or if no SLOs are provided by NMHED, input the SLOs used in assessment for the course.

Area and Essential Skills

Below gives information concerning the area and associated skills of the course to be re-certified. The area here matches the General Education Area of UNM; the "Essential Skills" and their respective Component Skills are characterizations of the area determined by NMHED. You will use this information to fill out the narratives below.

Area in which *PHYS 1240L* resides: Science

Essential Skills in the Area:

Critical Thinking

Problem Setting: Delineate a problem or question. Students state problem/question appropriate to the context.

Evidence Acquisition: Identify and gather the information/data necessary to address the problem or question.

Evidence Evaluation: Evaluate evidence/data for credibility (e.g. bias, reliability, and validity), probable truth, and relevance to a situation.

Reasoning/Conclusion: Develop conclusions, solutions, and outcomes that reflect an informed, well-reasoned evaluation.

Personal and Social Responsibility

Intercultural reasoning and intercultural competence

Sustainability and the natural and human worlds

Ethical Reasoning

Collaboration skills, teamwork and value systems

Civic discourse, civic knowledge and engagement -- local and global

Quantitative Reasoning

Communication/Representation of Quantitative Information: Express quantitative information symbolically, graphically, and in written or oral language.

Analysis of Quantitative Arguments: Interpret, analyze and critique information or a line of reasoning presented by others.

Application of Quantitative Models: Apply appropriate quantitative models to real world or other contextual problems.

Narrative Input

In the boxes provided, write a short (~300 words) narrative explaining how the course weaves the essential skills associated with the content area throughout the course. Explain what students are going to do to develop the essential skills and how you will assess their learning. The narrative should be written with a general audience in mind and avoid discipline specific jargon as much as possible.

Be sure to address the component skills listed next to each essential skills. The number of component skills that must be addressed by your narrative is listed.

Critical Thinking: *Problem Setting; Evidence Acquisition; Evidence Evaluation; Reasoning/Conclusion.*

In Physics 1240L, students perform experiments related to specific areas of physics such as electricity, magnetism, and optics. Critical thinking is crucial in both being able to properly perform an experiment and in ascertaining what the results of an experiment has revealed. Problem Setting: In order to properly perform an experiment and to understand why it is being done, a student must first be able to state what physical concept or quantity the experiment is probing. Evidence Acquisition: Next the student must gather the necessary data. In order to do this properly, students must have an understanding of how the apparatus in each day's experiment works and how it acquires and records data. Evidence Evaluation: Here students must validate that the apparatus used in the experiment is functioning properly and that the students are correctly reading the data provided by the experimental apparatus. This can be more challenging than in the first semester lab since each electricity and magnetism quantity is given its own unit therefore making the determination of what constitutes unreasonable harder to judge. It therefore falls on the instructor and lab manual to help the students develop this intuition with the upside being that it affords many opportunities to assess student development in this component skill. Reasoning/Conclusion: The sole purpose of an experiment is to help develop conclusions about the natural world. Physics, like all sciences, is inherently experimental. All laws of nature are conclusions gathered from evaluating the outcomes of repeated experiments.

The problem setting component skill will most likely be given by the instructor during their introductory material in a given experiment. The rest of the component skills of this essential skill will be developed in a hands-on way by the students themselves. Instructors

Personal and Social Responsibility: *Intercultural reasoning and intercultural competence; Sustainability and the natural and human worlds; Ethical Reasoning; Collaboration skills, teamwork and value systems; Civic discourse, civic knowledge and engagement -- local and global.*

As with all sciences, Personal and Social responsibility is an important part of Physics 1240L. Like all scientists, students are expected to be ethical individuals who contribute to the well-being of society and to the entire world, and, as such, are expected to develop all of the component skills in this essential skill. Sustainability and the natural and human worlds: Physics is a natural science; therefore, all of its topics touch directly on the natural world and most of them are directly related to sustainability. Specific examples from Physics 1240L include the learning of how electricity is generated and therefore understanding the difference between fossil fuel and renewable energy sources. In addition, the discussion of circuits includes an introduction to the workings and sustainability of batteries, their need for charging and the environmental impacts of their disposal. The Physics 1240L lab manual contains open-ended questions on these topics and others like them therefore aiding the students'development of a deep appreciation of sustainability and the natural world. Assessment data from these parts of the lab manuals or student surveys can be gathered to determine student proficiency. Ethical Reasoning: Ethical reasoning is at the core of all sciences. Our guiding principle, the scientific method, requires honesty in the gathering and reporting of experimental results. Students are expected to model this same honesty by gathering their own data, doing their own data analysis, and never plagiarizing others'work as their own. Comparing results across different groups can determine whether students are developing this component skill. Collaboration skills, teamwork and value systems: All laboratory courses, Physics 1240L included, are collaborative. As such, students are required to work together in groups of two or three during each class. In the acquisition of data, the analysis of that data, and the preparation of the lab report, group members must work with each other to determine which member performs each task. Student surveys, either written or online, can be used to gather assessment data that can be used to assess student growth in this component skill throughout the semester. Civic Discourse, civic knowledge and engagement: All teaching involves civic discourse and the teaching of physics is no exception. In turn students are expected to return this discourse to the instructor to show their mastery of the topics covered. To this end, student surveys or embedded laboratory manual questions can be used to assess a students growth in this

Quantitative Reasoning: *Communication/Representation of Quantitative Information; Analysis of Quantitative Arguments; Application of Quantitative Models.*

Since its invention, physics has used graphs to convey information simply and efficiently. In Physics 1240L, students continue developing the skill of gathering information from graphs that was begun in Physics 1230L. As such, students will develop and can be assessed on all of the component skills of this essential skill. Communication/Representation of Quantitative Information: In Physics 1240L, there is a much wider variety in the type of graphical representations encountered by students. Student must understand how the entire behavior of an electric or magnetic field can be summarized graphically using field lines. To understand the behavior and crucial aspects of a circuit, students must be able read and draw circuit diagrams. In magnetism, students must make extensive use of the famous "right-hand-rule" in determining the direction of the magnetic field, force, and torque. This rule is particularly challenging to students as it relies on bodily motion. The understanding of how electricity is generated relies on students being able to infer the slope of a graph. The topic of optics and electromagnetic waves makes extensive use of sinusoidal graphs. Students are expected to be able to determine the physical properties of a wave, such as its period and wavelength, from these graphs. Through assessment data gathered from the students' lab reports, mastery and understanding of this component skill can be assessed. Analysis of Quantitative Arguments: Students must always interpret, analyze, and critique the information given to them from others if they are to incorporate the subject matter into their mental models. Since lab classes, such as Physics 1240L, habitually have students working in groups, they are ideal for assessing this component skill. Every class requires students to interpret, analyze, and critique the information coming from their groupmates. Data from student surveys or embedded questions on lab reports will make it possible to assess the students' progress in developing this component skill. Application of Quantitative Models: As a natural science, all topics covered in physics quantitatively model problems and aspects from the real world. The specific topics of electricity, magnetism, and optics covered in Physics 1240L are no exception. By repeatedly participating in the acquisition and analysis of data, students are developing and then gaining mastery of this component skill. As such, assessment data from lab reports can be used to track and report on student progress in this area.

Additional Information

Course Materials

NMHED requires that both a syllabus and a sample course assignment (project, paper, exam,etc.) from the course in question to be attached to the recertification form. Be sure and pick an assignment that correlates with the descriptions provided in the narratives above.

Assessment Plan

When it is submitted to NMHED, each general education course will also have attached the assessment plan that is used for General Education Assessment at UNM. For more information on this process, please visit this page from UNM's Office of Assessment.

Physics 1240L Syllabus – Fall 2019

TA:
email:

Welcome to Physics 1240L! I am here to help you do your labs and learn some physics that may help you in your lecture and future courses. Always feel free to ask questions or make suggestions. Also, feel free to talk to the Lab Director in room RH 113, phone 277-2751.

Description

Physics 1240L is a companion course to Physics 1240 covering topics in electricity, magnetism, geometrical optics and wave optics at the algebra level. Lab activities mirror and enhance lecture topics. Hands on experiments involving data collection and analysis give students a better conceptual framework for understanding physics.
(Pre- or co-requisite: Physics 1240)

Objectives

This course serves to reinforce concepts presented in lecture, to give you experience working as a member of a team and to familiarize you with various experimental techniques.
Lab students will:

- Communicate and cooperate as a team to accomplish technical goals
- Read and interpret procedural instructions
- Gather and analyze data using electronic and optical devices
- Observe electrical, magnetic and optical phenomena
- Relate observed phenomena to mathematical and physical models
- Use basic laboratory equipment (e.g., timer, balance, rods, clamps, etc.)

List of Experiments – schedule is posted http://regenerlab.unm.edu/

- Uncertainty in Measurement
- Electric Force
- Electric Field
- Electric Potential
- Introduction to Capacitors
- DC Circuit Basics
- DC Circuits II
- Magnetic Field
- Magnetic Force
- Magnetic Induction
- Images from Lenses
- Reflection and Refraction
- Thin Lenses
- Spectral Analysis
- Holography

Materials

Lab workbooks are available at the UNM Copy Center in Dane Smith Hall. Every student is required to purchase one before the second week of lab. No copies will be provided.

Students with Disabilities

Qualified students with disabilities needing appropriate academic adjustments should contact me as soon as possible to ensure your needs are met. Handouts are available in alternative accessible formats upon request.

Attendance

Lab attendance is mandatory. You are responsible to perform all experiments.

- **Tardiness**
  You are expected to arrive on time to lab. If you are late, you will still be required to do the entire lab but your grade may be diminished at my discretion.
- **Excused absences**
  - If you cannot make it to lab and know in advance, contact me and we will arrange a time for you to do the lab.
  - If something comes up unexpectedly (sudden illness, accident, family emergency, etc.) contact me as soon as possible. Unscheduled absences WITH A VAILD EXCUSE must be made up. Contact me to arrange a mutually convenient time.
  - Missed labs must be made up promptly. If you do not make up a missed lab within one week, your grade may be diminished at my discretion.
- **Unexcused absences**
  One unexcused absence will reduce your final grade by one letter grade. Two unexcused absences will cause you to fail the class.

Conduct:

UNM has strict guidelines for both student and TA conduct, which are outlined in the University catalogue. Both the students and the instructor are expected to adhere to these policies. In particular:

- **Please do not answer cell phones, texts, or tweets in the lab room!! If urgent,** Calls may be taken in the hallway so long as classes are not disturbed.
- **Drinks must be in a container with twist cap or other sealed top and kept on the floor or at the front of the room.** Food in the lab is not allowed without special permission from the instructor.

Grading

Each week, you will receive a grade with two components: one for attendance/participation, and one for the physics and other details in the lab report. Attendance and participation will count for 1/3 of your semester grade. Lab report grades and quizzes which may be given at announced times will count for 2/3 of your semester grade.

Attendance/Participation Guidelines

A	Active Participation	Example behaviors: helps with set up, participates in data taking, asks questions, participates in discussions, etc.
B	Passive Participation	Example behaviors: is tardy to lab, merely records data, does not help with set up, does not participate in discussions, copies partners, etc.
C	Poor Participation	Example behaviors: Reads newspaper, does homework, antagonizes lab partners, etc.
0	No Participation	Not present in your section. Attendance in another section not verified by TA.

Lab Report Guidelines

A	Standard	The report is everything I would expect. All entries are complete, all questions meaningfully answered, data record including graphs is clear and correct, all calculations and units are correct. The report is organized and legible.
A-	Good	Report has minor error(s).
B	Acceptable	Report is OK, but there are errors and/or missing entries.
C	Unacceptable	Report has significant errors, unanswered questions, missing data, etc.
0	No Report	No report is turned in. Authorship not verified by TA.

UNM Academic Dishonesty Policy:

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course.

Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

Title IX

In an effort to meet obligations under Title IX, UNM faculty, Teaching Assistants, and Graduate Assistants are considered "responsible employees" by the Department of Education (see pg 15 - http://www2.ed.gov/about/offices/list/ocr/docs/qa-201404-title-ix.pdf). This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the Office of Equal Opportunity (oeo.unm.edu). If you want to retain anonymity, instead report the incident to other units on campus, namely Student Health and Counseling (SHAC), Counseling and Resource Center (CARS), a licensed medical practitioner on campus, or off campus to the Rape Crisis Center of Central New Mexico, or a sexual assault nurse examiner. If you report the incident to the LoboRESPECT advocacy center, Women's Resource Center, or the LGBTQ Resource Center, you retain anonymity but an anonymous record is made for statistical purposes. See more information at https://policy.unm.edu/university-policies/2000/2740.html#_Toc414642678.

Critical Thinking

Problem Setting: Delineate a problem or question. Students state problem/question appropriate to the context.
Evidence Acquisition: Identify and gather the information/data necessary to address the problem or question.
Evidence Evaluation: Evaluate evidence/data for credibility (e.g. bias, reliability, and validity), probable truth, and relevance to a situation.
Reasoning/Conclusion: Develop conclusions, solutions, and outcomes that reflect an informed, well reasoned evaluation.

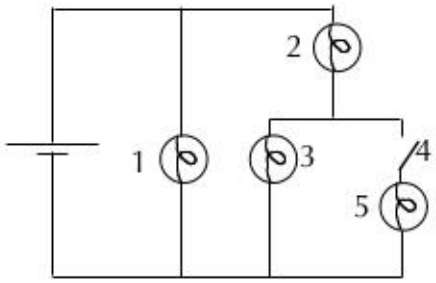
Sample Assessment Questions (These questions are all taken directly from the lab manual and could be used an embedded assessment on critical thinking. More traditional assessments such as the Conceptual Survey of Electricity and Magnetism could also be used here):

1. From the "Electric Potential" lab:

We have a large region of space that has a uniform electric field in the +x direction as indicated by the arrows in the diagram below. At the point (0,0) m, the electric field is 30 **î** N/C and the electric potential is 100 volts. Rank the electric potential from greatest to least at the following points within this region.
Please carefully explain your reasoning.
How sure were you of your ranking? (circle one)
Basically Guessed Sure Very Sure

2. From the "DC Circuits II" lab:

Predict what happens to the brightness of bulbs 1, 2, 3 and 5 when switch 4 is closed.



Personal and Social Responsibility - Address 2 of the 5 component skills

Intercultural reasoning and intercultural competence
Sustainability and the natural and human worlds
Ethical Reasoning
Collaboration skills, teamwork and value systems
Civic discourse, civic knowledge and engagement -- local and global

This activity from the "Magnetic Induction" lab and could be used to evaluate the Sustainability and the natural and human worlds component skill**.**

Generating Electricity

It seems fairly easy to cause current to flow in the coil. You have just demonstrated or seen several ways of doing this. A hand crank generator operates on the same basic principle you have been investigating. It is designed to optimize the interaction between magnet and coils and has gearing to increase the speed of the coil moving relative to the magnet.

1. Have each person in your lab team turn the crank of the generator a few times and note how much force is needed.

Question 20 It takes work to turn the hand crank generator. List what the work is accomplishing, or state why work is required to turn the crank.

2. Now connect the hand crank generator to the small light bulb in its holder.
a. Crank gently so that the light bulb does not "burn out."
b. Again have each person in your lab team crank it around a few times and note how much force is needed.

Question 21 Does it take work to drive the current in the light bulb? Describe your observation and explain.

The energy required to operate a 100W light bulb for one hour costs about a penny on your electric bill. This energy is easily calculated.
Energy = power x time = (100 W) x (3600 s) = 360,000 J

Question 22 Could you generate this much energy using your hand crank generator? How much mass would have to be lifted through a distance of 1 meter to generate this same energy?

I Googled "human power" and found this post on an alternative energy forum:
I keep looking but never seen anyone talk about how to convert the lifting and lowering of a weight into electricity. Maybe its too far out but humour me, If I move a weight of say 10lb over a vertical distance of 5 ft can we calculate the energy in watts. Do you have to go into newtons first? I will split the millions with you.lol! I thought about converting the force into rotary motion then into an alternator, not even sure if that is possible but thats why I thought I would write here. Those wave machines at the bottom

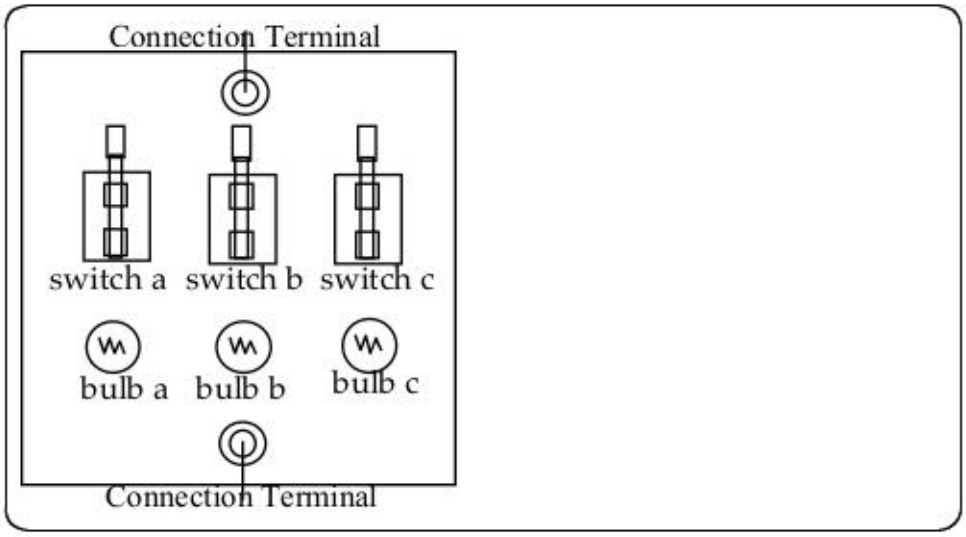
of the seabed are another possible design. You could move the magnet which is the weight, all ideas anyway- I hope its enough to get you thinking.
Question 23 The person who posted the note is suggesting an alternative way of generating electricity by converting “the lifting and lowering of a weight into electricity”. Based on your calculation in the previous question, what do you think of this idea? Is it practical or feasible? How would you respond the suggestion in the first paragraph? Write it out the way you would if you were responding to this post.

Quantitative Reasoning

Communication/Representation of Quantitative Information: Express quantitative information symbolically, graphically, and in written or oral language.
Analysis of Quantitative Arguments: Interpret, analyze and critique information or a line of reasoning presented by others.
Application of Quantitative Models: Apply appropriate quantitative models to real world or other contextual problems.

In Physics 1240L, there is a much wider variety in the type of graphical representations encountered by students. The “DC Circuit Basics” lab has the students perform the following activity.

Each light board used in this experiment has three bulbs and three switches. Compare your light board to the picture. Examine the back of the board to see the wiring. Then immediately to the right of the picture, sketch a circuit diagram using standard symbols. Draw circuit diagrams below assuming that one, two, and then three switches on the light board are closed. Label each resistor "R" to show that *we are assuming that each bulb has the same resistance R.*



Also encountered in Physics 1240L is the use of the “Right-Hand Rule” which is used in magnetism. This post-lab question from the “The magnetic Field” lab can be used to assess the students’ familiarity with the right-hand rule as well as the skill of vector addition.

Two long parallel wires carry a current of 3 A in opposite directions. Calculate the magnetic field for the points shown. Draw vectors (to scale) representing the two individual fields along with the net magnetic field. The wires are 2.0 cm apart. Point B is midway between them. Point A is 1.0 cm from wire 2. Point C is 1.0 cm from point B along a line perpendicular to BA.