Assessment for Physics 152

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The Department of Physics and Astronomy has set the following goals for Physics 152.

Goals:

1. Students will know and be able to apply basic physics concepts in electricity and magnetism, optics, and radioactive decay.

2. Students will be able to solve problems at the level of standard first year algebra – based general physics texts by using physics content knowledge in electricity and magnetism, optics and radioactive decay.

3. Students will be able to use appropriate scientific reasoning skills to work with physics content as required for national tests such as the MCAT, PCAT and DCAT.

4. Students will be able to use appropriate mathematical skills needed to solve problems.

5. Students will be able to make use of units, vectors and graphs as needed to solve problems.

The success in meeting these goals will be assessed by the following outcomes. The outcomes were chosen to cover some of the most important topics and to demonstrate a range of skills in solving problems, not necessarily to cover all the topics in the course.

Outcomes:

Outcome 1 – Coulomb's Law: Students will be able to solve problems using Coulomb's Law. Examples would include understanding the inverse square dependence of Coulomb's law, calculating the total electric force on a charge due to 1 other charge, and using superposition to calculate the total force from two other charges or to combine an electric force with another force such as gravity.

Relates to NM HED Area III-4: Apply quantitative analysis to scientific problems

Outcome 2: Magnetic Fields: Students will understand magnitudes and directions of magnetic fields. Examples would include finding the magnitude and direction of a magnetic force on a moving charge or a current carrying wire, recognizing how we know that a current carrying wire

produces a magnetic field, calculating the magnetic field due to a current carrying wire, and determining if a particular field would affect a compass.

NM HED Area III competency 1, 4 and 5: Scientific Process, Apply quantitative analysis to scientific problems, Apply scientific thinking to real world problems.

Outcome 3: Simple Circuits: Students will be able make calculations involving simple circuits. Examples would include recognizing series and parallel resistors, calculating current, resistance, voltage and power, and showing where a voltmeter or ammeter is connected to a circuit to measure voltage or current.

NM HED Area III Competency 2 and 4. Solve problems scientifically. Apply quantitative analysis to scientific problems.

Outcome 4: Geometric Optics: A student will be able to recognize and draw correct ray diagrams for geometric optics and perform related calculations. Examples would include plane mirrors, spherical mirrors, lenses, and the transitions between materials of differing indices of refraction.

NM HED Area III competency 3. Communication of scientific information.

Outcome 5: Faraday's Law: Students will be able to determine the direction of induced currents and find the magnitude of induced voltages. Examples would include changing B fields andmoving loops. An application example could include the basic concepts pertaining to transformers.

NM HED Area II competency 2, 4 and 5. Solve problems scientifically.Apply quantitative analysis to scientific problems, Apply scientific thinking to real world problems.

Assessment Data Collection:

For each outcome the material will be covered in lecture using an appropriate mix of demonstrations, presentation of theory, examples and keypad questions. Homework will ask students to work problems related to these outcomes skills. Students taking the lab will also cover some of the material in lab. Many students will also see the material in problem sessions and supplemental instruction sessions. Assessment will come from exams as that is easier to monitor individual student achievement as opposed to using homework assignments for which considerable help is available. Keypad assessments can be used for some of the easiest questions, though one has to consider the issue of student collaboration.

Individual teachers will provide questions in coordination with the department assessment coordinator for each outcome. For multiple choice questions, several questions for each outcome should be used to test different aspects and difficulty levels. These questions can be split across multiple exams such as a midterm and a final exam. For workout problems more information can be gathered from each problem especially if a problem contains multiple parts or is scored with partial credit. Therefore for workout problems each outcome should have one or more

problems. The workout problems have to be designed to assess more than one piece of an outcome and to assess various skill levels of an outcome.

Rubric:

Evaluation: Different teachers place different emphasis on the topics and only the teachers themselves are aware of the true difficulty and context of the questions (whether examples were worked in class, whether clicker exercises were used in class and how many homework problems addressed the subject are examples). Only the teacher of the class is in a reasonable position to determine the curve and grading scale for the test. Likewise, only the teacher of the class is in a position to correctly evaluate performance on the outcome questions.

For each SLO, there should typically be either three or more multiple choice questions covering the broad concept, or one or more workout problems that use the concept in more than one context and that can be graded to show different levels of mastery.

The SLO can be assessed with either of two methods. Method 1 assesses students' performance based on the percentage of questions they answered correctly in each rubric as a group. The instructor can then examine the percentage of students demonstrating Exemplary, Satisfactory, or Unsatisfactory performance on each SLO. Method 2 is more simply based on the average score of all students on all questions in each rubric. The instructor can use this average score to decide if the class performance as a whole is Exemplary, Satisfactory, or Unsatisfactory. The table below provides more detail on what is meant by Exemplary, Satisfactory, or Unsatisfactory performance on each SLO.

Physics 152 Rubric for Grading Outcomes Assessment

Exemplary	**Satisfactory**	**Unsatisfactory**
Method 1: a student correctly solves all three problems (or at least 75% if more than 3 multiple choice problems). For a workout problem a score of 75% typically means that a student demonstrates understanding of solving the problem and correctly apply relevant definitions, equations and concepts. A student may make a small error in solving the problem. Method 2: the average score of students on the problems is at least 75%.	Method 1: a student correctly solves at least 50% of the problems. Makes a mistake in concepts or applying equations. For a workout problem a student makes an attempt consistent with course content but has misunderstood a needed concept or misremembered a formula or made several smaller mistakes. Method 2: the average score of students on the problems is 50-75%	Method 1: a student solves 50% or less of the problems correctly. Doesn't know definitions, equations and concepts. Cannot apply definitions, equations and concepts to a problem. Makes multiple errors. For a workout problem shows serious lack of understanding in solving problems. Method 2: the average score of students on the problems is less than 50%.