PHYSICS 220:  Physics for Designers: 3 credits  
Syllabus, Spring Semester 2015

Classes: 1:30-4:00 p.m. F  
Instructor: Dr. Orven Swenson  
Office: South Engineering 220B  
Phone: 231-6294  
Email: orven.swenson@ndsu.edu  
Prerequisite: Math 105 or equivalent  
Office Hours: 1:00-3:00 p.m. TW or by arrangement.

Room: Renaissance 214  

Course Materials (available at NDSU Bookstore):  
(2) Scientific or graphing calculator.  
(3) Laptop computer  
(4) Four scantron/opscan sheets and a #2 pencil.  
(4) Optional: Student Companion & Problem-Solving Guide [by R. Grant].

Prerequisite: MATH 105 – Trigonometry (or equivalent).

Course Description: Application of physics concepts and principles for designers such as architects, interior designers, and engineers using focused problem-solving in work-groups. Topics selected from mechanics, sound, thermodynamics, optics, electricity, magnetism, and modern physics.

Course Objectives: This course is intended to teach designers such as architects, landscape architects, interior designers, and engineers, the fundamental principles of physics and how to apply them in design problem solving.

The process of construction of a house will be used as a vehicle and metaphor to systematically explore the fundamental principles of physics and study how they are applied in the design and construction of the house. A pedagogical approach that utilizes situated learning, the education is imparted through focused problem-solving that is undertaken in workgroups that operate in a ‘design lab’ environment. The content covered will be what is normally covered in foundational courses in physics taught to freshmen and sophomores.

General Education: This course has been approved for the General Sciences category in general education because it introduces you to the “concepts and methods of inquiry” in physics and the integration of those “ideas in a coherent and meaningful manner” by applying the principles of physics in solving the design problems of constructing a house.

General Education Outcome 5 (“Comprehend concepts and methods of inquiry in science and technology, and their applications for society”): Students will demonstrate their comprehension of physics concepts through the LON-CAPA homework assignments and exams and the successful application of the methods of inquiry through successful solutions of the in-class problems.

General Education Outcome 6 (“Integrate knowledge and ideas in a coherent and meaningful manner): Students will demonstrate this outcome primarily through the solution of the real world house construction problems that require applying physics equations and principles in a coherent and meaningful manner in order to arrive at an acceptable solution.

Course Format: In-class problem-solving is the primary learning method for this course. You will meet one day per week to work on tutorials or design projects in the project classroom. The in-class

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problems/tutorials will be assigned weekly for a total of 12 sessions covering the various aspects of physics as they apply to the design of built environments. Lectures and reading material will be provided online introducing the concepts to be learned through the design projects. The tutorials will emphasize higher order thinking in order for students to comprehend physics concepts. Homework questions/problems will be assigned using the LON-CAPA online homework. The Blackboard online course management system (http://bb.ndsu.nodak.edu) will be used to post course announcements, Tegrity videos, question and answer discussions, grades, and other information; please check the website often for updates.

Grading Policies: Grades will be assigned based on the following scheme: A ≥ 89.5%, 79.5% ≤ B < 89.5%, 69.5% ≤ C < 79.5%, 59.5% ≤ D < 69.5%, F < 59.5%. The instructor reserves the right to lower the grade cutoffs in response to class performance, but they will not be raised. Your course grade will be based upon the number of points you have earned out of the 500 points possible, as shown below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Points Possible</th>
<th>Relative Percentage</th>
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<tbody>
<tr>
<td>Unit Exams</td>
<td>200 (2@100)</td>
<td>40% (2@20%)</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>20%</td>
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<tr>
<td>Homework</td>
<td>55</td>
<td>11%</td>
</tr>
<tr>
<td>On-line Self-Assessment</td>
<td>25</td>
<td>5%</td>
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<tr>
<td>Group in-class tutorials/problems</td>
<td>120</td>
<td>24%</td>
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<tr>
<td>Total</td>
<td>500</td>
<td>100.0%</td>
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Unit Exams: Three in-class “midterm” exams will be given, each of which will be based primarily on material covered since the last exam, but certain questions may require previous knowledge. Each exam will be multiple-choice in format, consisting of a mix of conceptual and computational problem-based questions. A calculator will be required for successful completion of the exams; all other electronic devices must be turned off and stored. The use of calculator software in cell phones, translators, laptop computers, etc., is not permitted on an exam. A sheet containing relevant formulas will be provided with each exam. Any changes to the exam dates listed below will be announced well in advance of each exam. Your lowest of the three unit exam scores will be dropped. Bring a #2 pencil, photo ID, calculator, and scantron sheet for each exam.

Make-Up Policy: No make-up exams are allowed, so if you miss a unit exam, it will automatically be dropped as the lowest scored exam. If you are absent for more than one exam, you should meet with the instructor as soon as possible (prior to the exam, if possible) to provide documentation of the reason for your absence and to determine how to proceed; this will be handled on a case-by-case basis. Exams may be taken early, subject to the instructor’s discretion.

Final Exam: The final exam will be comprehensive and will be held during Finals’ Week. The final exam cannot be dropped. A make-up of the final exam will not be allowed unless extreme, documented circumstances warrant it.

In-class problems: You will be assigned to an in-class group, optimally 4 members, for the semester. One legible solution per group will be turned in on 8 1/2” x 11” paper ONE SIDE ONLY. SHOW all work. GIVE ALL EQUATIONS before substituting numerical quantities into them and always give the UNITS INVOLVED. UNDERLINE all answers. The students in the group may be asked to present and/or discuss their solutions in class. Each group needs to decide on their group rules. A group grade will be assigned for each in-class tutorial/problem. If you have an excused absence, you will receive your group’s grade for that in-class problem. Students with unexcused absences will receive no credit for missed in-class tutorials/problems.

Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

Homework: Homework problem sets on current course material will be assigned via the LON-CAPA online homework system. There will be three problem sets prior to each in-class meeting during normal

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weeks. **No late homework will be accepted.** You may work together on homework sets, but do not simply copy another’s answers; this will not benefit you when it comes to the exams or in real life applications.

*LON-CAPA Instructions:* The online homework can be accessed by selecting the appropriate server at http://www.ndsu.edu/physics/lon_capa/. Your username is everything to the left of the @ in your NDSU email address (use all lowercase letters), and you will establish a password by selecting the “Forgot password?” link when you first log in to the system. For help using LON-CAPA, please contact your instructor as soon as possible.

**Special Needs:** Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

**Academic Responsibility:** The academic community is operated on the basis of honesty, integrity, and fair play. *NDSU Policy 335: Code of Academic Responsibility and Conduct* applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the *Office of Registration and Records*. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academic honesty.

**Topic Outline:** The tentative schedule:

Week 1. Introduction.
Week 2. Motion, Forces, and Newton's Laws.
Week 3. Forces and Motion in Two and Three Dimensions.
Week 5. **Exam 1**/Momentum, Impulse, and Collisions.
Week 6. Center of Mass and Rotational Motion
Week 7. Fluids.
Week 8. Harmonic Motion and Elasticity.
Week 9. Waves and Sound.
Week 10. **Exam 2**/Temperature and Heat.
Week 11. Thermodynamics.
Week 12. Electric Forces and Fields
Week 15. **Exam 3**/Electric Circuits and Magnetic Fields.
Week 17. **Final Exam** Tuesday, May 12 from 1:00 p.m. – 3:00 p.m.

**The instructor reserves the right to adjust or modify this syllabus if it is deemed beneficial to student learning.**