Physics 103 Lab  
Fall 2009

Meeting location: Trexler 274  
Instructor: P. Nelson  
Email: nelson@roanoke.edu

Meeting time: Th 1450 – 1750  
Office: Trexler 266B, x5250  
Office Hours: M, 1530 – 1630  
W Th, 1000 – 1130

**REQUIRED MATERIALS:** Lab handouts (pre-lab, lab exercise and post-lab questions) will be made available on Blackboard (Bbd). You will need to print the entire lab handout and bring it with you to lab.

**GOAL:** The following learning goals will serve as an overall framework for the laboratory activities: *The Art of Experimentation, Experimental & Analytical Skills, Conceptual Learning, Communication and Collaborative Learning Skills.*

This course is designed to enhance your learning and understanding of the topics covered in lecture via hands-on application of the physical principles introduced in the lecture text. The main emphasis will be on clarifying and expanding your understanding of these topics. You will be introduced to new experimental techniques and methods of error analysis. You will also receive practice in clearly communicating your experimental results via technical writing.

**INTENDED LEARNING OUTCOMES:** Upon completing this course, successful students will

- be able to conduct scientific experiments in a manner that allows them to obtain thorough, *accurate* data;
- formulate hypotheses and cogently and coherently discuss the results of an experiment in light of these hypotheses;
- be able to specify sources of error that appear in an experimental process *and*
- present experimental results in a coherent, well-organized, *written* manner.

**ELECTRONIC DEVICES USAGE POLICY:** *If it beeps, whistles, rings, vibrates or runs off batteries of any kind, leave it at home (unless it functions solely as a calculator).* The use of all cell phones, pagers, PDAs, MP3/CD players, portable gaming consoles or any *other* electronic entertainment or communication device is strictly prohibited during class time. This means that these devices must be turned completely *off* (not set to vibrate).

During class, the computers in this room are to be used *only* for the completion of assignments directly associated with this course. You may *not* use them for completing assignments for other courses, checking email, IMing, ‘social networking,’ general web-surfing or for any other activity which is not directly associated with the current class assignment in this course. You may use your own, personal laptop for note taking, if you wish. You may not use it in any manner that violates the above policies and procedures.

**ATTENDANCE:** A portion of your Physics 103 grade is based upon your performance in the laboratory; therefore, you must register for *both* a lecture and a lab section. (Registering for a lecture does not automatically enroll you in the lab – and *vice versa!* )
You may only attend the lab section for which you are registered, unless you obtain permission from both lab instructors at least 24 hours prior to the earlier of the two lab sections. It is your responsibility to contact the relevant instructors. Your lab report is still due by the date & time specified below.

Lab start and end times are non-negotiable. Most labs, however, will not require the entire class period. You are expected to arrive prepared and on time! Anyone who arrives more than 10 minutes late will not be permitted to perform the lab and will receive no credit for the in-class portion of that day’s activity.

Make-ups must be arranged at least 24 hours prior to your absence. The only exceptions are those cases of unavoidable circumstance (death, medical emergency, court appearance, etc.). In these instances, a note signed by a governing official (doctor, law enforcement officer …) must be provided.

**Weekly Lab Exercises:** You will conduct the in-class portion of the lab exercise in groups of no more than 2 – 3 people, unless the instructor gives permission otherwise. At the end of the period, each group member should have an identical copy of the data collected during the lab, in either electronic or paper form.

For each in-class lab exercise, you will submit a lab report consisting of a pre-lab exercise and a write-up. Lab reports will be worth a total of 100 points, divided as described below. A detailed breakdown of the guidelines may be located on Bbd.

**Pre-lab Assignments:** [25 points] Pre-lab materials will be posted on Bbd. You must complete the pre-lab assignment prior to lab. Pre-labs are due at the beginning of lab – no exceptions!

**Write-up:** [75 points] Lab reports must be typewritten (except as noted below), stapled and have a minimum spacing of 1.5 lines between each line and 1-inch margins (no more, no less!). Please use black ink for text; graphs may be in color, if you wish). Each report must contain the following, sections:

A. **Heading** (5 pts). This section should contain, in order, the title of the lab, your name, the date the lab was performed and the names of all lab partners.

B. **Abstract** (20 pts). The abstract consists of 1–2 paragraphs briefly outlining the purpose of the lab, as well as predictions (hypotheses) as to the expected outcome. You should also include a short statement of the physical phenomena investigated during the activity and the principle results (your final numerical values, with errors) obtained.

C. **Data** (20 pts). List all data collected in tabular/chart form, as appropriate, labeled and with correct units. You should also include your results, with error analysis (also in table/chart form), labeled and with units. This section also includes all graphs, including trend lines, equations and R² values, labeled, with correct units. Finally, you must provide sample calculations (one of each type) and drawings or free-body diagrams, as appropriate; these may be neatly hand-written. Be sure to state equations formally before inserting numbers. You should also explain, in words, what each symbol means.

D. **Conclusions** (30 pts). This is a 1–3 paragraph summary of your findings. Include a statement specifying whether your results agreed with your hypotheses. This statement should include a brief explanation (why you claim your results agree or disagree with the predictions) and sources of error. (“Human error” is never an acceptable explanation for
disagreement with the desired results.) You should also answer any concluding questions posed in the lab handout in this section.

Label all sections, except the heading. A report template is available on Bbd. Review this sample carefully as you prepare each of your reports. The deadline for submitting write-ups is 8AM on the Wednesday after the lab. You lose 10 points for each day the write-up is late.

Additionally, you should not discard graded lab reports or pre-labs until the end of the semester. If there is a discrepancy between the grades recorded on the report and on Bbd, I will ask to see the graded report. If you cannot produce the report, the grade will stand as recorded.

**ADDITIONAL LAB REPORTS:** In addition to the weekly lab reports, each individual will submit a more detailed write-up as outlined in the course outline. The format of these reports will be similar to that of the weekly lab reports. You will submit the original, graded copy of the report along with the revised edition. Each of these reports will be graded out of 150 points. In addition, you will submit two copies of these reports: a typed, stapled hard copy and an electronic copy, which you will submit via SafeAccess on Bbd.

For the first additional write-up, choose one of the experiments performed prior to Fall Break and re-evaluate your results if the effects of friction are included. Each section should include the items mentioned above, the original results and the results with friction included (both with errors). The description of the lab should reflect the new purpose.

Some new items to include:

**A. Heading** (10 pts.). The heading should reflect the new purpose of the experiment.

**B. Abstract** (40 pts). This should include a brief statement(s) (i.e., hypotheses) about how you expect friction to change your results. It should also include the original result and the results with friction included (both with errors). The description of the lab should reflect the new purpose.

**C. Data** (50 pts). Include the original results (data, formulae and calculations). As appropriate, you should also add a column to your tables, and a line to your graphs, for the data with friction included. As before, you will need to provide equations and their explanations, both with and without friction. You must also provide sample calculations for each equation used.

**D. Conclusions** (50 pts). Discuss the effects that friction had on the experiment. State whether your results agree with your predictions and any sources of error. I may provide additional questions that should also be addressed here.

For the second additional write-up, choose any of the activities carried out this semester and prepare a report stating how the concepts studied in this lab apply to the “real world.” In particular, you must state the applicability of the chosen physical principle(s) to your own particular area of study or to a discipline of interest to you (if you have not yet declared a major). As with the first additional write-up, you should follow the format of the weekly lab reports.

**A. Heading** (10 pts.). The heading should reflect the new purpose of the report.

**B. Abstract** (40 pts). This should include a brief statement describing the field of study and specific reasons you selected this lab to analyze for this assignment. The description of the lab should reflect the new purpose.

**C. Data** (10 pts). Include the original results (data, formulae and calculations).
D. **Relevance** (80 pts). Include 4–5 paragraphs explaining, in detail and with citations, how the physical concepts studied in this lab relate to the chosen field (discipline). Specifically, you should cite how the data you collected and each of the individual experiments performed during the particular lab relate to your chosen topic. You should cite specific examples from your field indicating how these experiments and techniques used in this lab exercise pertain to the chosen topic.

E. **References** (10 pts.). This paper must include a list of formatted references/bibliography. The bibliography should contain at least three distinct sources, published within the past 5 years. ‘Wikis’ do not count as legitimate (i.e., authoritative) references; wiki entries may, however, provide leads to additional resources.

**ACADEMIC INTEGRITY:** All work submitted must be your own! I expect you to adhere to the academic integrity policies as outlined in the brochure, *Academic Integrity at Roanoke College*.

Any work submitted may not be copy-and-pasted from other sources, even from your own lab partners. Data collected must illustrate your honest effort to perform the experiments; falsifying data is considered cheating. The data collected by your group can be shared among its members. The group can perform data analysis as well; in fact, I encourage you to do so. You must present any conclusions in your own words.

In other words, your group cannot print one copy of the report for each person in the group. Each report should express your own unique style and interpretation of the data.
**Tentative Lab Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lab Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Aug. 27</td>
<td>No lab this week!</td>
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<tr>
<td>2</td>
<td>Sep. 03</td>
<td>Course Policies</td>
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<td></td>
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<td>Lab 1 – Introduction: Dimensional Analysis &amp; Units</td>
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<td>3</td>
<td>Sep. 10</td>
<td>Lab 2 – Motion &amp; Acceleration</td>
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<td>4</td>
<td>Sep. 17</td>
<td>Lab 3 – Projectile Motion and Equations of Motion</td>
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<td>5</td>
<td>Sep. 24</td>
<td>Lab 4 – Force &amp; Equilibrium</td>
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<td>6</td>
<td>Oct. 01</td>
<td>Lab 5 – Work &amp; Energy</td>
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<td>7</td>
<td>Oct. 08</td>
<td>Lab 6 – Energy and Momentum Conservation</td>
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<td>8</td>
<td>Oct. 15</td>
<td>Fall Break <em>(No labs this week!)</em></td>
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<tr>
<td>9</td>
<td>Oct. 22</td>
<td>Lab 7 – Rotational Kinematics</td>
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<td><em>Additional Write-up #1 due @ beginning of lab</em></td>
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<td>10</td>
<td>Oct. 29</td>
<td>Lab 8 – Energy in Rotational Motion</td>
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<td>11</td>
<td>Nov. 05</td>
<td>Lab 9 – Fluid Statics and Dynamics</td>
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<td>12</td>
<td>Nov. 12</td>
<td>Lab 10 – Periodic &amp; Simple Harmonic Motion</td>
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<td>13</td>
<td>Nov. 19</td>
<td>Lab 11 – Standing Waves</td>
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<td>14</td>
<td>Nov. 26</td>
<td>Thanksgiving Break <em>(No lab this week!)</em></td>
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<td>15</td>
<td>Dec. 03</td>
<td>No labs this week!</td>
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<td><em>Additional Write-up #2 due @ 5 PM</em></td>
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