ROWAN UNIVERSITY
PATTERNS IN NATURE II: PROJECTS IN CALCULUS AND PHYSICS (MATH 03-315-1)
SYLLABUS FOR SPRING 2012 (CRN# 21169)
MW 12:15 pm – 2:45 pm, SCI BLDG 151, 4 sem. hrs.

INSTRUCTOR: Dr. M. Herman **EMAIL**: herman@rowan.edu
OFFICE: Robinson Hall, 2nd Floor **OFFICE HOURS:** by appointment **PHONE:** 256-4500 x 3539
Mathematics Department (please email to set up an appointment) (Note: phone is **rarely** used)

REQUIRED TEXTS: Five books from Cambridge 16-19 Mathematics series:
Newton's Laws of Motion (NLM). 1991. Dolan. ISBN: 9780521388450
Modeling with Circular Motion (MCM). 1993. Snape. ISBN: 9780521408899
Modeling with Force and Motion (MFM). 1993. Snape. ISBN: 9780521408912
Introductory Calculus (IC). 1993. Snape. ISBN: 9780521388436
Calculus Methods (CM). 1992. Baxter. ISBN: 9780521408929

TECHNOLOGY: The TI-83 or TI-84 graphing calculator is required for this course and is permitted for use on all course activities, including any quiz or exam. Each student must have his/her own calculator. Calculators may *not* be shared on a quiz or exam. Cell phones and other electronic devices are *not* permitted in class, and such technology is *not* permitted on any quiz or exam. Email will be used as a communication tool between Dr. Herman and students. Email from Dr. Herman will be sent to students' Rowan email accounts throughout the semester.

OVERVIEW: This course will focus on mathematical models and physical outcomes. The emphasis will be on the development of calculus from a conceptual point of view and the ability to create mathematical models of physical situations. Our studies will focus on concepts, hands-on experiences, and calculations to give us a firmer understanding of our universe around us. This class fosters the growth of creative, independent thinking so the student will then have the tools to understand and analyze new concepts.

PREREQUISITES: With our goal being, in part, a mathematical modeling of our world around us, proficiency with algebra and trigonometry will be assumed. It is also understood that students have taken at least a descriptive physics class, so we expect some degree of familiarity with general physics concepts. Students are also expected to have some proficiency with a graphing calculator. Familiarity with general spreadsheet and word processing programs will be very helpful.

ATTENDANCE: Students are expected to attend class regularly and will sign an attendance sheet on a daily basis. Because this class is based heavily on group work and discussions, your attendance is ***mandatory***. Absence and tardiness jeopardize the ability of the class, and your group, to complete assignments and is disrespectful of their work and preparation. Absence on the day of a regularly scheduled quiz/test will automatically result in a grade of zero (0). **No make-up exams or assignments will be administered.** Be in class, be on time, and be prepared — *excessive absence or tardiness will lead to a lowering of the final grade. (*Also note: **The instructor is not responsible for covering material missed when a student is absent.** That is, rather than asking the instructor to re-teach material to a student who misses a class, the student should catch up on missed notes and assignments with a classmate.)

STUDENTS WITH DISABILITIES AND SPECIAL NEEDS: Disabilities and special needs are documented at the Office of Disability Resources in the Academic Success Center in Savitz Hall (x4233 or x4234). Students who wish for special services must provide a Notification of Accommodation letter from the Office of Disability Resources to the instructor as soon as possible at the beginning of the semester. The instructor is not responsible for providing accommodations until she receives the notification letter.

WITHDRAWAL POLICY: Dates and policies regarding withdrawal from the course will follow Rowan University protocol, including the three deadlines for withdrawal during the semester. Note that the university's policy on course withdrawals during the last four weeks of the semester is that a student may withdraw only if there are circumstances beyond his/her control which prevent him/her from completing the course requirements.

Jan 24 – Mar 5, 2012	W	Student, Professor
Mar 6 – Apr 4, 2012	WP/WF	Student, Professor, Department Chairperson
Apr 5 – May 5, 2012	WP/WF	Student, Professor, Department Chairperson, Dean

ACADEMIC HONESTY: All work on individual quizzes and the Final Exam must be your own. The penalty for a cheating offense will minimally be an automatic zero (0) on the related exam, up to an automatic F in the course with a report to the Provost's Office. Procedures regarding dishonesty will follow Rowan University policies, as outlined in the Academic Honesty portion of the Student Information Guide available online.

GRADING: The course is graded out of a total of 1000 points.

Presentations of solutions to problems comprise 200 points (100 Reading Problem, 100 HW Problem);
Lab write-ups are worth 250 points (125 each);
Quizzes (best 10 of 12) count for 300 points; and
the Final Exam is worth 250 points.

See the course calendar for all assignment due dates. Grades will follow the standard percentage scale with the following cut-off percent values: A 93, A- 90, B+ 87, B 83, B- 80, C+ 77, C 73, C- 70, D+ 67, D 63, D- 60.

READING AND HOMEWORK ASSIGNMENTS: The homework schedule outlines the text reading assignments and topics to be discussed on each day of the course. **Reading** sections and problems are assigned *before* a given class and are due the day of the discussion for that topic. Reading problems will not be handed in; rather, students will present one reading problem solution to the class during the semester. More in-depth **homework** problems are assigned *after* a topic has been discussed. Again, these will not be handed in, but students will present one homework problem to the class during the semester. Thus, the homework portion of the grade is composed of the scores from these two presentations. See the grading rubric for how presentations of problems will be scored (100 pts each).

LABS: Students will keep track of their experiments in their class notebooks; all notes, data, figures and commentaries should be a part of their notes. Twice during the semester, students will turn in a formal report. See the lab report format guidelines and sample grading rubric for how lab write-ups will be scored (125 pts each).

QUIZZES: Weekly quizzes will be given in the first half-hour of every Wednesday class. Half of these quizzes will be performed in groups, the other half will be performed individually. To minimize disruption to those students taking the quiz, *tardy students may be denied access to the quiz until other students have completed the quiz and thus may be forced to take a zero for that quiz.* There are no make-up quizzes. Each student's best ten quiz scores will be included in the grade calculation at the end of the semester (30 pts each).

FINAL EXAM: There will be a cumulative individual Final Exam (250 pts) at the end of the course, covering topics from class notes, reading and homework assignments, quizzes, and labs.

Problem Presentation Grade Sheet

Name:_____ Problem: Reading _____
Date: _____ HW _____

Note: Generally speaking, homework presentations should be between five minutes and ten minutes in length. You may use any available technology during your presentation, in addition to the blackboard.

I. Introduction -- includes reading entire problem from assignment (20 pts.): Score: _____
- 4 – Poor to nonexistent
- 12 – Vague objectives and presentation direction
- 20 – Good attention grabber; lays clear foundation of presentation objectives; closes with clear results

II. Content (40 pts.): Score: _____
- 14 – Wrong approach in solution; fails to answer question
- 28 – Achieves answer with minor math errors, but has trouble explaining answer; struggles to use correct terminology
- 40 – Fully covers the question; clearly understands the material; explains things in non-technical terms

III. Eye Contact/Hands & Body Movement/Articulation & Semantics (10 pts.): Score: _____
- 2 – Poor eye contact; distracting movements; hard to hear
- 6 – Moderate eye contact; somewhat comfortable; struggles for words
- 10 – Makes eye contact with everyone in the room; little reliance on notes; completely comfortable; movements never seem awkward; speaks in clear sentences; excited about topic and conveys enthusiasm

IV. Visual Aids (10 pts.): Score: _____
- 2 – Poorly designed; sloppy writing on board
- 6 – Average attempt
- 10 – Excellent integration of slides or board work resulting in enhanced learning

V. Conclusion / Questions (20 pts.): Score: _____
- 4 – Poor responses to questions; clearly does not understand material
- 12 – Struggles explaining an understood concept
- 20 – Answers clearly and succinctly to questioner's satisfaction

Total (100 pts.) **Total Score**: _____

Comments:

Patterns in Nature II Lab Report Format

There are two key words for the successful lab report - succinct and complete. These may seem at odds with one another; however, if you keep them both in mind as you write you will have a much nicer report. The first reminds us that we must say only what is necessary to make our point or show what we mean. The second reminds us that we must be able to fully convey our ideas. Thus, the lab report is intended to fully describe what was done, how it was done, and discuss any and all conclusions and implications of the experiment, yet do so w ith as little distracting text as possible.

The lab report should be broken down into four major parts: (1) introduction and statement of purpose, (2) procedure, (3) data and results, and (4) conclusions and discussion. Each part is weighted equally as each part is equally important to task of explaining the experiment.

The introduction is where you briefly describe what it is you were planning to do. In this paragraph or two you will discuss the goal of the experiment and the reason for doing the experiment, *i.e.* what were you expecting to learn or understand from the lab exercise. You should also include here a brief description of what underlying principles are at work and how this experiment fits into the "big picture". Finally a **statement** of the final result is made.

The procedure section is where you describe how you carried out your experiment. This section should **not** be a laundry list or recipe of steps taken. It should be a *prose* account of what equipment you used, how it was set up to achieve your results, and how you went about collecting your data. Note that this is supposed to describe what you did, not what was written down on the lab handout – you may have done things slightly differently due to how your equipment worked (or did not work). You also want to note any difficulties you had with the equipment which could lead to uncertainties in your data and results.

The data and results section is where you present the data you collected in some kind of succinct format. Standard options are usually a well labeled table and/or graph. You want to be very clear about which numbers are measured data and which are calculated results. Be sure to discuss here the methods used to go from "raw" data through the data processing to the final results. This does not mean showing all your algebraic steps for each and every point, but rather a *prose* description of the processing steps. The Data & Results section is where you simply present your data and any calculated results. Save the discussion and interpretation of those results for the discussion section.

Finally, the conclusions and discussion section is where you tie everything in the previous two sections to your introduction and purpose section. You will show how your results agree with you stated purpose and what that means to the "big picture", or you discuss how your results miss the mark and what this implies about either the "big picture" or the experimental procedure itself. You should also discuss your experimental limitations and uncertainties (*e.g.* do the possible uncertainties in your measurements account for differences between your experimental values and theoretical values?) and note also what could perhaps be done differently to achieve better results. As a guide for some of this discussion, use the Questions for Thought sections of your lab handouts. This does not mean to be sure to have a paragraph where you state the question and answer it but rather to work into your discussion (and introduction!) the ideas in these questions as they will usually relate to "big picture" types of ideas.

Other suggestions:

*Use superscripts and subscripts. You can highlight any character and click Format-Font and choose the appropriate style.
*If you want to do real equations, you can click Insert-Object and choose Microsoft Equation to open the equation editor.
*You are describing work *you* did so there should be no phrases such as "...directed..." or "...supposed to..."
*You can leave out any unnecessary details such as things you did to practice with the equipment. Basically, ask yourself, "Is this information necessary for me to make or clarify my point?" If not, leave it out. Examples: Things you did wrong but fixed, names of people doing parts of the experiment, etc.
*In your conclusions, be sure to tie it back to your purpose and be sure to back up your statements with your observations and results and possible uncertainties. Also try to discuss how your results fit into the "big picture." Note that many of the questions throughout the lab pages are there to get you to think about just these ideas, but you should **not** just end with a Q&A session.

PATTERNS IN NATURE II
LAB REPORT GRADING RUBRIC
FIRST LAB WRITE-UP

Following general instructions **5 points**

Group names, Title of Lab
Lab Report in 4 major parts
Labels for Intro/Statement, Procedure, Data and Results, Conclusions

Introduction

Description of underlying principles / "big picture" **9 points**
including the type of relationship that theoretically should or may hold between variables -- linear (Hooke's Law), quadratic, cubic, quartic, logarithmic, exponential, power, logistic, or trigonometric (sine).

Goal(s) of experiment **7 points**

What you expected to learn or understand or figure out,
including how the lab should theoretically work out **7 points**

Statement of final result - Did your lab results match the "big picture" ideas? **7 points**

Procedure

Prose write-up, not Q&A "laundry list" **5 points**

Equipment and set-up, any difficulties with equipment **10 points**

Description of how you collected data **15 points**

Data and Results

Correct choice and description of independent and dependent variables **6 points**

Well-labeled table of collected experimental data with appropriate units **7 points**

Well-labeled scatterplot graph of collected experimental data with independent variable plotted on x-axis and dependent variable plotted on y-axis **7 points**

Equation that models plotted data, with description/work of how equation was found and why it is the best fit for the data (using R^2), along with a graph of the equation with the plotted data **10 points**

Conclusions and Discussion

Interpretation of your equation that models data, including discussion of y-intercept and slope (if linear) with appropriate units in context of experiment
(Ex: What is does the y-intercept and/or slope of your equation tell you about the data and how does it compare to your actual data?) **16 points**

Description of how your experimental results agree with or miss theoretical expectations that you described in your introduction -- Does your equation model the type of relationship you thought should or would hold between variables? If not, why not? **8 points**

Experimental limitations, uncertainties, ways to improve (ex: more data) **6 points**

TOTAL **125 points**

PATTERNS IN NATURE II
LAB REPORT GRADING RUBRIC
SECOND LAB WRITE-UP

Following general instructions **5 points**
- Group names, Title of Lab
- Lab Report in 4 major parts
- Labels for Intro/Statement, Procedure, Data and Results, Conclusions

Introduction
- Description of underlying principles / "big picture" **9 points**
  Ex:
  *Explain how Atwood's Machine works and why it is used to find *g*
  *Explain projectile motion in terms of position (r), velocity (v), and acceleration (a)
  *Describe the notion of conservation of energy (including PE, KE, and EPE)
- Goal(s) of experiment **7 points**
- What you expected to learn or understand or figure out, including how the lab should theoretically work out **7 points**
- Statement of final result – Did your lab results match the "big picture" ideas? **7 points**

Procedure
- Prose write-up, not Q&A "laundry list" **5 points**
- Equipment and set-up, any difficulties with equipment **10 points**
- Description of how you collected data **15 points**

Data and Results
- Well-labeled chart of collected data including appropriate units **10 points**
- Correct calculations developed from collected experimental data including appropriate units **10 points**
- Work and explanation for any experimental calculations developed from collected data (ex: g, v_o, k, PE, KE, EPE) **10 points**

Conclusions and Discussion
- Correct calculations with appropriate units for and/or discussion of theoretical expectations (ex: g, r, v, a, R, H, PE+KE+EPE) **7 points**
- Work and explanation for any theoretical calculations **7 points**
- Description of how your experimental results agree with or miss theoretical expectations, including "percent difference" calculation if applicable **10 points**
- Experimental limitations, uncertainties, ways to improve (ex: more data) **6 points**

TOTAL **125 points**