Physics 201: Newtonian Mechanics
Spring 2018

Meeting: Trexler 372
Instructor: Matthew C. Fleenor
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Time: MWF 9:40 – 10:40AM
Office: Trexler 266D
Office Hours: W 3.30–5.00PM
W R F 1.00 – 2.30PM or by appt.

webspace: faculty.roanoke.edu/fleenor/index.html

Required Textbook: *Physics for Scientists and Engineers*, 8th ed., Serway & Jewett, ISBN13: 978-0-49582781-8

Required Prerequisites: Math 118 or 121 (Calculus I)

I. Components of Learning

There are several factors that make a course "good" (by good, I mean a healthy combination of the intellectual and the affective). Good courses are also clear about their essential components. Below is an attempt to be clear about how will I operate within PHYS 201, as well as my expectations of a student who is enrolled in PHYS 201.

Descriptions

Aspiration: Physics is a framework for observing and appreciating the physical universe, in as much as it is a manner of explaining the phenomena within it. Therefore, a few different levels of interpretation exist for the sentence, "I understand physics." My approach in this course is a 'both/and' mentality, where both the conceptual understanding (and dare I say, appreciation) and the analytical problem-solving approach can mutually coexist. Arguably, if you don't have both an interest in the conceptual and the mathematical, then eventually neither will deepen. I will provide the proper atmosphere and avenues so that neither of these necessary levels of understanding need to be sacrificed. My goal for you is that you will walk away with a deeper understanding in each of these contexts.

Newtonian mechanics implies that we will focus primarily on describing the motion of macroscopic objects that we can tangibly see and touch. One of the amazing things about the physical world is that there are many parallels between the visible macroscopic world and the world of fields and microscopic phenomena. Therefore, we should not take lightly the lessons learned within the mundane world of the everyday since it will serve us well in the future when more intriguing phenomena are introduced.

Expected Learning Objectives: Sucessful students will –

1. demonstrate a proficiency with the use of units and

   estimation;

2. display a working knowledge between the various kinematic quantities and their graphical representation;
3. manipulate common problems utilizing forces and free-body diagrams utilizing Newton's laws of motion;
4. analyze different contributions of the total energy of a system and comment on how the energy is conserved;
5. determine the centripetal force for uniform circular and show that the net force is not equal to zero;
6. calculate the velocities for a two-body system using the conservation of linear momentum;
7. analyze the linear and rotational counterparts in general kinematics;
8. demonstrate an understanding of the effect of inertial moments on the conservation of mechanical energy;
9. describe oscillatory motion and superposition using three different physical models.

Attendance: Although roll will not be taken, daily attendance is expected. Due to the mathematically rigorous nature of the course, you may not miss more than *fourth* classes without a legal excuse (court, hospital, police, etc.). Late arrivals greater than 10 minutes will constitute an official absence. The fifth absence for which there is no legal excuse will constitute your (forced) withdrawal from the course.

Office Hours: Please take advantage of the office hours prescribed above, or make an appointment with me. Drop-ins are at the total mercy of my daily schedule.

Inquire (NQR**):** I use the NQR environment extensively to place notes, announcements, assignments, *proofs*, *solutions*, links, and other course documents. Please do NOT forget to check NQR before you come to class or if you have a question about previous assignments.

Academic Integrity: I want to foster a mutual respect for the classroom hours that we have together. In light of this, please remember to silence cell phones, electronic devices, laptops, etc. during class and come prepared. Please ask if you want to use these devices for educational purposes in class. Refer to the
"Academic Integrity" page on the RC website– http://roanoke.edu/A-Z_Index/Registrar/Policies_and_Information/Academic_Integrity.htm
Included here is an explanation of how violations of the College's academic integrity policy are handled.

Grades: Standard letter grades (A–F) are assigned according to the following scale for this course: "A"(91–100), "B+"(88–90), "B"(83–87), "B–"(80–82), "C+"(78–79), "C"(74–78), "C–"(70-73), "D"(60– 69), "F"(< 60).

II. Modes of Learning

Rubric

Your grade is determined according to the following distribution:

Exams (3)	30%	Homework	15%
Final	15%	On-line/Classwork	10%
Lab (201L)	20%	Quiz (weekly)	10%

Descriptions

Exams: All exams are planned (by me) for completion in 1.0 hour, however, you will have up to 1.25 hours to complete each exam. Since the class begins at 9.40 a.m., each student has the option to arrive at 9.30 a.m. and begin the exam or hold the exam until 10.50 a.m. NOTE: If you have a class that begins at 10.50, it is *your* responsibility to plan for the late arrival into your next class. All exams will contain comprehensive material from the previous chapters, most probably the one/two *most* missed problems from the previous exam/quizzes. The final exam will be given in class and will be cumulative. Make-up exams will only be allowed as a result of a discussion with me **beforehand** or a note related to the emergency (death, hospitalization, misdemeanor, etc.) *signed* by a governing official (medical doctor, parent, law enforcer, etc.).

Quizzes: Weekly quizzes (FRIs) are completed individually or as a small group (my discretion) in class and graded. The quiz will consist of one partial problem from the class discussion, which contain the *more* important concepts and/or phenomena. Typically, the problem will not be numerical in nature.

Problem Sets: Un-/assigned problems (like those in the problem sets) are "**when and where**" you will learn the course material. For better and for worse, there is no way to learn the depth of the material within the one-hour sessions that we will have together. Due to the nature of problem solving, I expect that you will work together *toward* a solution. However, I also expect that you will create an original solution to each assigned problem. Substitutions and simplifications should **NOT** be left to the "reader" (that's me) to figure out. If necessary, words and phrases need to be properly placed so that I can follow your train of thought. Problem sets are your final draft essays and/or compositions that display the fruit of your higher-level critical thinking skills, so you need to view them in that light. These can be completed in electronic format or by-hand (neatly). If you do not follow these guidelines, I will return them to you for completion. I can provide examples of the kind of work that I expect on a final submission for the problem sets.

Labs: Physics exists because there is a connection between the mathematical world of symbols and the empirical world of measurement. Verifying the mathematical results of physical theory is an important component of the course. Creating words and sentences that express the results of experimentation is an extremely underrated (yet important) component of carrying out the enterprise of science. To think that you can carry out significant experimentation without adequate writing skills is foolish.

On-line/Classwork: What it means to "participate" in Physics 201 should include the following: on-line quiz completion, listening (and responding) to audio-video lectures, attentive attendance, engagement in question and answer, working on in-class problems, reflective write-up for two extracurricular lecture or presentations, and responsibility for your own learning (office hours, etc.).

III. Daily Course Outline

In what follows, you will see the plan for working through the course. Each course meeting provides a section of the text, a conceptual topic, and a homework problem to reinforce the topic. Quizzes and Exams are also marked on the course outline, so please refer to it often. The **bold-faced** class periods require the watching of an audio-video lecture BEFORE class. The *italics* class periods denote a class discussion on the Heart of Darkness and an in-class quiz. If there are deviations from the following outline, I will certainly draw your attention to them.

PHYS 201 Course Outline, Spring 2018

Week	Date	Sections	Topic	Homework
	15-Jan	1.1 – 1.6	Units, Conversions, Dimensional Analysis	1.12, 1.28
1	17-Jan	2.1 – 2.3	**Position and Instantaneous Quantities** 2.5	
	19-Jan	2.4 – 2.5	Motion diagrams	2.15
	22-Jan	2.6 – 2.7	Particle analysis under constant accel	2.23
2	24-Jan	3.1 – 3.3	**Vectors, scalars, and components**	2.57
	26-Jan	3.3 – 3.4	Vector analysis and unit vectors	3.11,20
	29-Jan	4.1 – 4.3	Vectors of motion and projectiles	4.5
3	31-Jan	4.3	Projectile motion 4.12	
	2-Feb	4.3	Projectile motion	4.23
	5-Feb	4.4 – 4.5	**Uniform circular motion and components**	4.30
4	7-Feb	4.4 – 4.5	Uniform circular motion and components *Review*	
	9-Feb		*EXAM 1: IN-CLASS (C. 1—4)*	
	12-Feb	5.1 – 5.3	**Force, inertia, and mass**	5.1
5	14-Feb	5.4 – 5.5	Newton's second law and weight 5.7	
	16-Feb		Newton's third and analysis	5.22
	19-Feb	5.6 – 5.7	Frictional Forces and analysis	5.45
6	21-Feb	6.1—6.2	**Circular motion and forces** 6.13	
	23-Feb	7.1 – 7.3	Work completed by a constant force	7.1
	26-Feb	7.4 – 7.5	Work-Energy theorem and kinetic energy	7.15
7	28-Feb	7.6 – 7.9	**Potential energy and conservative forces** 7.33	
	2-Mar	8.1 – 8.2	Conservation of energy problems	8.3
	5-Mar			
8	7-Mar	*Spring Break: No Classes*		
	9-Mar			
	12-Mar	8.3 – 8.4	Conservation of energy with friction	8.9
9	14-Mar	9.1 – 9.2	**Linear momentum and 1-D collisions**	
	16-Mar	9.3 – 9.4	Linear momentum and 1-D collisions	9.4
	19-Mar	9.3 – 9.4	Linear momentum and 1-D collisions	
10	21-Mar	9.5	2-D collisions and conservation *Review*	
	23-Mar		EXAM 2: IN-CLASS (C. 5—8)	
	26-Mar	9.3 – 9.5	Linear momentum conservation	9.19
11	28-Mar	10.1 – 10.3	**Angular quantities and kinematics** 10.7	
	30-Mar	10.4 – 10.5	Rotational kinetic energy and moments	10.19
	2-Apr	10.8 – 10.9	Energy of rolling objects	10.25
12	4-Apr	10.6 – 10.7	**Torque and Analysis** 10.36	
	6-Apr	11.1 – 11.3	Vector product and angular momentum	10.38
	9-Apr	11.4 – 11.5	Conservation of angular momentum	
13	11-Apr	EXAM 3: IN-CLASS (C. 9—11) *Review*		
	13-Apr			
	16-Apr	12.1 – 12.3	**Objects in Static Equilibrium**	11.11
14	18-Apr	15.1 – 15.2	Simple harmonic motion (SHO) 12.11 20-Apr 15.3 – 15.4 SHO Energy and Equation of Motion 12.37	
	23-Apr	15.4 – 15.5	Circular motion and other periodic motion	15.5
15				
	27-Apr		***FINAL EXAM: CUMULATIVE (2—5 PM)***	