JOHN JAY COLLEGE OF CRIMINAL JUSTICE
The City University of New York
GENERAL PHYSICS (PHY 203) SYLLABUS

Spring, 2013

***** Overview for both LECTURE and LAB Curricula *****

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and *by appointment*. Even during office hours, advance communication and/or scheduling by email are always best.

Semester Credit Hours: 4 per Semester
Prerequisite: Math 241

This is the first semester of a two semester introductory course designed to provide the student with a rigorous command of the fundamental principles and problems comprising both classical and modern physics. The topics covered this semester comprise the heart of classical mechanics (kinematics, dynamics and conservation). The central theme is Galileo's Principle of Relativity. This theme will be expressed in nine distinct but logically consistent forms: After the first three forms are introduced, each next form will frame the next chapter of material. The ultimate course purpose is to extend the predictive power of the relativity principles to the retrodictive program of modern forensic science.

Textbooks:

Halliday, D., Resnick, R. & Walker, J. *Fundamentals of Physics*, 9th Edition.

Accommodations for Students with Disabilities: Qualified students with disabilities will be provided reasonable academic accommodations if determined eligible by the Office of Accessibility Services (OAS). Prior to granting disability accommodations in this course, the instructor must receive written verification of a student's eligibility from the OAS which is located at L66 in the new building (212-237-8031). It is the student's responsibility to initiate contact with the office and to follow the established procedures for having the accommodation notice sent to the instructor.

Statement of the College Policy on Plagiarism: Plagiarism is the presentation of someone else's ideas, words, or artistic, scientific, or technical work as one's own creation. Using the ideas or work of another is permissible only when the original author is identified. Paraphrasing and summarizing, as well as direct quotations require citations to the original source. Plagiarism may be intentional or unintentional. Lack of dishonest intent does not necessarily absolve a student of responsibility for plagiarism. It is the student's responsibility to recognize the difference between statements that are common knowledge (which do not require documentation) and restatements of the ideas of others. Paraphrase, summary, and direct quotation are acceptable forms of restatement, as long as the source is cited. Students who are unsure how and when to provide documentation are advised to consult with their instructors. The Library has free guides designed to help students with problems of documentation.

Learning Outcomes:

Upon completion of this course, a successful student should be able to:

1) ***KNOWLEDGE:*** Know the meaning and relationships among velocity, acceleration, force, linear momentum, angular momentum and energy – as well as between instantaneous and average functions. The successful student will know Newton's Laws of Motion and the three fundamental theorems of conservation.

2) ***KNOWLEDGE***: The student will know that a classical application of such laws uses information in the present in order to make predictions about the future. Conversely, the student will know that this program of classical physics, when applied to the modern context of forensic science, uses information regarding the present in order to make retrodictions and discoveries regarding the past.

3) ***REASONING***: The successful student will apply the calculus perspective on intervals of infinitely large and infinitely small dimension to physical situations. Conversely, the successful student will derive calculus principles from analysis of the properties of motion through space and time.

4) ***REASONING:*** Relate and apply nine distinct but logically consistent forms of Galileo's Principle of Relativity in order to solve problems regarding kinematics, dynamics and conservation in space and time. The successful student will ultimately infer, apply and abstract how all inertial frames of reference produce distinct but equally correct measurements; s/he will reason from and to the premise that velocity is relative.

5) ***REASONING***: The successful student will grasp that a well-chosen coordinate system can make all the difference between a solution method that is merely correct and a solution method that is not only correct, but also convenient, clear and concise. Finally, the successful student will see how the laws and topics of classical physics, as well as the driving assumptions of modern forensic physics and criminalistics, can be deduced from Galileo's Principle of Relativity.

6) ***PRACTICAL SKILLS:*** Design, build, measure, analyze and trouble-shoot mechanical experiments involving inclined planes, pendulums and collisions. Use calculus and careful English in order to develop techniques for solving never-before-seen problems. Use Logger Pro and Excel software in order to gather data and relate independent to dependent variables.

7) ***COMMUNICATION SKILLS***: Approach physics as a language, rather than as a body of information. Through "Board Meeting" lab activities, Socratic lectures and didactic assignments intended to be handled collaboratively, the successful student's command of quantitative material will be expressed and assessed verbally. The successful student of physics will come to regard equations as complete sentences.

Course Web-Page:

www.yaverbaum.org

Consult ***regularly***—every day—for syllabus, assignments, course information and updates. The web-page is used for the assignment calendar, supporting documents, exam preparation: in short, everything. Blackboard provides a link to the above site.

Read the course web-page from left to right. The left-most column refers to the date of a particular class or lab—depending on which page you look at. The next column provides a brief title for the subject matter to be covered in class that day. The assignment column tells you WHAT IS DUE THAT DAY (***not*** what is assigned that day). The last column highlights relevant principles, equations or expressions for that topic.

*** The course Web-Page is dynamic; it responds in real-time to the flow and needs of a particular class. The advantage is that the class becomes that much more student-driven. The disadvantage is that students are required to be flexible. Be prepared for changes in the sequence of assignments. Check the web frequently and do not try to work many weeks in advance of assignments. Always understand that you will be tested on the correct solutions to problems that are presented on the chalkboard in class—as opposed to explanations in the text and as opposed to solutions attempted by students in response to homework assignments. ***

The assignments and labs are quite often links to original documents. You are always expected to ***print out and bring*** whatever is due and relevant for a particular class meeting.

You are then expected to complete all assignments on separate sheets of paper.

The assignments are NOT exercises intended to review what was already discussed in lecture. They are the reverse. They are problems to consider and attempt to solve ***prior to lecture.*** Each problem set assumes that you have done the relevant reading and that you are trying your best to push yourself to the next level of problem-solving skill and concept application. The lecture is designed to clarify and assist with questions you have developed in your attempt to solve fresh problems. It is for this reason that you are awarded credit for thoroughness, clarity and engagement with the problems -- rather than for accuracy of answers.

Course Policies

Labs and Lab Grading.

1) Every lab activity is done in a group of four (4) people. The groups will change two (2) times in the semester. The lab-group change dates will be indicated on the lab web-page.

2) The assignment for each lab can be found on the lab web-page. It must be downloaded, read thoroughly and printed out prior to lab period.

3) ONE LAB REPORT PER GROUP will be submitted a week after each typical lab and graded on a 1-10 scale. The lab report CANNOT BE HAND-WRITTEN.

4) All lab reports must conform to a FOUR PART format that is contained and explained in detail in the first lab assignment. All details of this four part format, as explained in the first lab assignment, must be met in every lab report, unless explicitly otherwise stated. In brief, the four parts are:

    i. Title Page,

    ii. Methods & Findings Section

        --always includes, among other requirements,

        a fully labeled diagram (not photograph),
        a thorough uncertainty analysis and
        a clear and concise conclusion

    iii. Special Instructions and Questions ("Triple-Starred") that apply to a given particular lab and/or were found in the particular lab hand-out,

    iv. Appendices

5) Lab Activities known as "Board Meetings" are highly specialized discussion formats—involving the presentation of student work on white "Boards". For these discussions, no lab report is assigned. The lab report grade is instead assigned as follows:

0 = Absent from discussion.
8.5 = Present for discussion, but not actively participating.
10 = Present for discussion and contributed at least one substantive and respectful comment.

6) There will be no lab mid-term; there will be at least one “Lab Practicum”.

7) We supply student laptops for laboratory investigations.

8) If you know in advance that you have to miss a lab, you obtain permission of your lab instructor to join another lab period. If the instructor for that lab period gives you permission, you will complete your lab work in a different lab section that week.

9) You may miss and make up exactly one lab by the method described in (5), above.

10) For any missed labs beyond the one, you will not be able to receive a grade for the associated work.

11) Instructors have the discretion not to assign a passing grade—for the entire course—to any student who is missing for more than three lab periods.

12) ***The average of all your weekly 10-pt lab write-ups (approximately fourteen) will count for essentially 20% of your entire Physics 204 grade.*** (See below for precise details.)

General Grading:

1) Every assessment which is scored out of 100% (one "Final Exam", one "MidTerm Exam", one "Quest", one "Final Lab Grade") is given ***precisely*** equal weight. One arithmetic mean is computed from all such assessments. This is your pre-assignment class average: the "Assessment Mean". When all is said and done, these assessments will together constitute ***approximately*** 80% of your final grade (with lab being, as stated above, 20%). The rest of this formula explains how the remaining portion -- ***approximately*** 20% -- the "Assignment Credit"—gets factored in. The comparative weights of the Assessment Mean and the Assignment Credit will vary slightly from semester to semester, but never from student to student and never sum to anything other than 100%. This nuanced part of the system is designed to acknowledge and reward the process of growth undergone by each particular class as it pursues success on assessments.

2) Every assignment which is scored out of 4 (homeworks, labs) is added together. Every zero results in the *deduction* of 1 point from this total. The sum is divided by a constant weighting factor (such as 5). This weighting factor may differ from semester to semester and is dependent on the overall class dynamic, participation and calendar.

3) The result from step (2) is treated as pure percentage points and added to your Assessment Mean, described in step (1). This produces your pre-participation class average.

4) All points gained on written "Extra Credit" Assignments as well as 0 or 1 points of "Class Participation" points are added to your pre-participation class average. This class participation evaluation is based on signs of your vocal and auditory engagement in lecture, group-work ethic in lab and general assignment trend (e.g. a great many "4"'s have an impact that goes beyond the straight numerical sum). The sum of steps (1), (2) and (3) is your Final Class Average.

5) Please do note: The seeming complexity of the above system is in place so that your homework grade reward CONTINUAL EFFORT AND THOROUGHNESS above all else—even above accuracy of results. As a result of this system, the weighting percentages will not always be precisely 80% + 20%. From semester to semester, they fluctuate slightly around such round numbers. All four large assessments will ***always***, however, be weighted equally. The grading weights will always, moreover, be precisely ***uniform from student to student and from section to lab section***.

The BOTTOM GRADING LINE:

Each formal assessment is given equal weight in a straight average.
The sum total of all homeworks and extra credits amount to raw points added straight onto your class average.
For example, homework itself can amount to approximately 7 extra points on your class average.
You cannot "lose" points on homework unless you literally do not submit it.

May the net force be with you.

Physics 203 LECTURE: Spring 2013

John Jay College of Criminal Justice: The City University of New York

Daniel Yaverbaum

LAST UPDATED FEBRUARY 24, 2013

Procedures & Policies

email me

DATE	LECTURE	READING	ASSIGNMENT	PRINCIPLE
February 1	Introduction: Train of Thought	No Reading Due for First Class	No Problems Due for First Class	***Galileo's Principle of Relativity*** **Form #1:** The laws of physics hold in all ***un***accelerated reference frames. **Form #2:** No experiment can detect an absolute speed or direction through space. **Form #3**: All speeds and directions are relations; the motion of one object is not meaningful without comparison to another object.
February 8	Intuition Inventory	Chapter 1 AND Chapter 2: Sections 2.1, 2.2, 2.3	1. Number Line 2. Average Speed	$\bar{v} \equiv \frac{x - x_0}{t}$
February 15	First Principles: Retrodiction & Relativity	Remainder of Chapter 2 AND Chapter 3: Sections 3.1, 3.2, 3.3	1. Average Acceleration 2. Free Falling Up	$\bar{a} \equiv \frac{v - v_0}{t}$ $\bar{v} = \frac{v + v_0}{2}$

				$x = \frac{1}{2}at^2 + v_0t + x_0$ $x = \frac{v^2 - v_0^2}{2a}$
February 15	Defining Terms for Kinematics: Average Speed, Average Velocity	Chapter 3: Sections 3.4 - 3.7;:	Big Ol' Duck	$\sin^2\theta + \cos^2 = 1$
February 22	Intro to 2-D Kinematics: Displacement Vectors	Chapter 4: Sections 4.1 - 4.6, 4.8 - 4.9;	Vector Addition Generalized Projectiles	***Galileo's Principle of Relativity*** **Form #4:** $\vec{v}_{ac} = \vec{v}_{ab} + \vec{v}_{bc}$
February 22	Velocity Vectors; Projectiles	HW 1: SOLUTIONS Chapter 5		***Galileo's Principle of Relativity*** **Form #5:** Unless acted on by a net external force, an object at rest stays at rest and an object in motion stays in motion at the same speed and in the same direction.
March 1	Transition to Newton's Laws: GPR #5 The Left Side of Newton's Second Law	Chapter 6	Free-Body Diagrams and System Schema	$\sum \vec{F} = m\vec{a}$
March 1	Friction	Review all problems that have been presented in class.	At home, take: PRACTICE MID-TERM (updated 11:59 am, 10/7/11) For the Mid-Term, you are responsible for everything up through and including the beginning of Newton's Laws. More specificity will be provided on 11/17/12.	$f_k = (mu)_k N$ $f_s(max) = (mu)_s N$
March 8	Newton Law Enforcement	Continue to prepare:	Make certain you can at least solve ALL previously solved problems without looking. This includes but is not restricted to the: SOLUTIONS to Practice MidTerm.	***Galileo's Principle of Relativity*** **Form #6:** If object ***A*** exerts a force on object ***B***, then

			In class, I will continue to teach Newton's Laws and to address the Mid-Term	object ***B*** exerts a force on object ***A*** of equal magnitude and opposite direction.
March 8	Work & Energy		NII.1 (Newton's 2nd Law/. Problem Set 1) You are responsible for the entire problem set above. Begin Homogeneity Packet: You are only responsible for the first two problems. They are both found in the text.	
March 15	MID-TERM **PREP:** Chapters 1 - 6 (inclusive)	Chapter 7	Study. Hard.	***Galileo's Principle of Relativity*** **Form #7:** Space is homogenous; Linear momentum is conserved.
March 15	Conservation Theorems: Energy & Linear Momentum	Chapter 8	Continue Homogeneity Packet	
March 22	***** MID-TERM ITSELF *****			
March 22	Homogeneity vs. Isotropy	Chapter 9. Note: This assumes you have kept up and read Chapters 7 and 8, as assigned above.	Extra Credit Assignment: RETRODICTION -- Not Due Until 11/14/12 --	***Galileo's Principle of Relativity*** **Form #8:** Time is homogenous; Energy is conserved.
April 5	Conservative & Conservation	Chapter 10		
April 5	Potential Energy		If you opt for extra credit, Complete & Submit Retrodiction Assignment	
April 12	Inelastic Collisions	Chapter 11	Complete & Submit Homogeneity Packet	
April 12	Perfectly Elastic Collisions	Chapter 12		
April 19	Explosions		START: Revolve, Rotate & Roll, Pages 1-4	
	Revolution, Rotation &			

April 19	Rolling: Centripetal Acceleration		SUBMIT: Revolve, Rotate & Roll, Pages 1-4	
April 26	Galileo Revisited	Chapter 13	.	
April 26	Vertical Circles			***Galileo's Principle of Relativity*** **Form #9:** Space is isotropic; Angular momentum is conserved.
May 3	Conical Pendulum		L2.81 Sections 1 & 2--> 2:50pm - 4:05pm Sections 3 & 4--> 1:30pm - 2:45pm	
May 3	Banked Curves, Globes & Gravitation		SUBMIT: Revolve, Rotate & Roll, All Remaining Pages	
May 10	Orbits, Coming Full Circle: GPR **SYNTHESIS**	The Gravitation Assignment --> Will NOT be collected.	a) HRW, p. 351: Problems 1, 9, 17, 29, 45 b) Imagine a universe in which Newton's Law of Universal Gravitation were identical in all other respects to ours, but an ***inverse-cubed*** function of distance rather than an ***inverse-squared*** function of distance. (This would be true in a universe with 4-dimensional, rather than 3-dimensional space.) Assume that all other definitions of motion, such that for average speed and that for centripetal acceleration, are the same in all universes. From this Newton's Law and any other fundamental definitions (such as the two just mentioned), derive what Kepler's 3rd Law would be in such a universe. Make certain to derive an actual statement of equality, not just one of proportionality	
			REVIEW PROBLEM PACKET! --Please Note: You should go to thi3 after you have mastered the practice exam. Some problems have been intentionally selected from prior assignments, some will look new	

May 10		PRACTICE EXAM **SOLUTIONS**	and some will be familiar if you happened to download last semester's practice exam. All of them have been intentionally selected in order to provide you with a clear set of expectations for the exam itself. They all represent its concepts, form and, in SOME cases, its explicit content. NO SOLUTIONS will be provided. Either you already have them or you have to work together.	
May 24	FINAL EXAM	In Lecture Classroom: 10:50 am - 12:50 pm	**SOLUTIONS** **to Review Problem Packet**	

Note: All assignments are 1) highlighted, 2) ***DUE*** the day on which they appear and 3)

Physics 204: Lecture&Lab	Physics 203: LECTURE	Educational Equity
Skies of Yesternight	Physics 203: LAB	Elements