

# Syllabus for an Independent Study in Classical Mechanics (PHY 485-102) - Fall 2016

## Weekly Meeting: Science Building, Room 152 – (M 1-2pm)

**Course Description:** This is a 3-credit hour independent study course focusing on Classical Mechanics that is aimed at the upper level undergraduate student. Solving real world problems in this class will require the use of algebra, trigonometry, advanced calculus, vectors, and even more advanced mathematics. This independent study course will cover nearly the same material as **PHY 330**, except now there will be no lecture component to the course. In place of lectures, you the student, will learn the material through lots of reading on your own time (I will provide you with some notes here and there to assist you). That is why some say an independent study is a kind of reading course. As required, I will also assign weekly homework and exams during the semester. We will meet once a week regularly (Mondays at 1pm) so we can discuss the sections of the book, future readings, turn in homework, and ask questions. It is expected that you come to me for help whenever you need it during your reading, homework, and when you have questions. **PHY 330**, the course in which this independent study will be based off of, is “[a]n intermediate study of the fundamental principles of statics of particles and rigid bodies, momentum and energy, dynamics of particles, harmonic oscillations, and wave motion ~ fall 2016 undergraduate course catalog.”

**Objectives:** More specifically, this independent study is designed to provide you with a basic understanding of: scalars, vectors, vector calculus, Newton’s laws of motion (including motion of projectiles and charged particles), momentum and angular momentum, energy, oscillations, calculus of variations, Lagrange’s equations, Hamiltonian mechanics, two-body central force problems, mechanics in non-inertial reference frames, rotational motion of rigid bodies, coupled oscillators & normal modes, and if time permits, wave motion; these are all key aspects of science that form some of the fundamental foundations of the physical world that surrounds us every day. Ideally, all the forementioned topics will be covered (this will be a decently paced independent study, 12 chapters in 15 weeks; don’t fall behind, if you do, seek help immediately). Some topics might have to be omitted due to unexpected and unforeseen circumstances that may arise throughout the semester. Students are responsible for staying up on the course reading, completing the homework, and preparing for the exams. All homework and exams are mandatory and must be taken. You are expected to show up at our normal weekly meeting time.

**Learning Outcomes:** In the process of learning the fundamentals of physics described above in this course, the overarching goal, independent of your major, is to help hone your critical thinking, analysis, problem solving, and quantitative reasoning skills. In order to accomplish these goals successfully, you will be given lots of **practice** via written homework problem sets that will be due weekly. Your individual success in achieving this goal will be **assessed** by your individual performance on examinations. **A tentative reading schedule is found at the end of this syllabus. Dates and subjects may change on this tentative schedule (I will let you know if there is a change of plans).**

**Course Instructor Info:** Dr. Sean P. McBride<sup>†</sup>, Science Building 152, (304)-696-2758, [mcbrides@marshall.edu](mailto:mcbrides@marshall.edu)  
Office Hours: (M 11-12pm & 2-3pm), (W 10-12pm), & (F 10-12pm) or by appointment  
<sup>†</sup>Mailbox located in the Physics Department main office, Science Building, Room 251

**Required Textbook:** “Classical Mechanics” by John R. Taylor  
ISBN-13: 978-1-891389-22-1

**Non-required Resources:** “Classical Dynamics” by Thornton and Marion, 5<sup>th</sup> Ed.  
ISBN-13: 978-0-534-40896-1

“Analytical Mechanics” by Fowles and Cassiday, 7<sup>th</sup> Ed.  
ISBN-10: 81-315-0111-6

“Classical Mechanics” by Goldstein, Poole, and Safko, 3<sup>rd</sup> Ed.  
ISBN-10: 0-201-65702-3

**Prerequisite Courses:** MTH 231 - Calculus with Analytic Geometry III,  
& PHY 203 - College Physics II, or PHY 213 – University Physics II

**Computer Requirements:** Access to MU Online is required. I use MU Online to distribute additional notes that supplement your reading. I will also send notices to your Marshall e-mail account if communication outside of our standard meeting time is needed. You are expected to check both of these regularly. All electronic course communication must be through your Marshall account (not gmail, yahoo, etc). Written homework grades, homework solutions, announcements, lecture notes, and so-on, will be posted on the course web site, accessed through MU Online. Sign in at [www.marshall.edu](http://www.marshall.edu) in the upper right corner using your unique MU username and password.

**Required Reading:** It is required that you read the sections of your textbook that are outlined in the tentative course schedule. You should certainly read the corresponding sections prior to attempting the homework and exams. It is recommended that after we meet you download and study any additional notes I may have provided. Study your book, any provided notes, your homework & given solutions, your notes from reading the book, your previous exams, and come ask questions at any time during the week and/or during our weekly meetings.

**Help for This Course:** If you are starting to experience difficulties in this class, there exist several resources available for you to obtain additional help. Resolve these difficulties quickly, before they snowball out of control. I will have six office hours per week (shown on page 1) or we make an appointment if these office hours do not work for you. Or, you can simply drop by Science 152 at any time, and if I have additional time to help you, I will.

<b><u>Grading:</u></b>	Written Homework:	40%
	Take Home Exams (3 total, 15% each)	45%
	Final Take Home Exam	15%

<b><u>Determination of Final Grade*:</u></b>	90% or above:	A
	80% or above:	B
	70% or above:	C
	60% or above:	D
	Less than 60%:	F

\* I reserve the right to adjust these values based on the overall class performance, thus stay on top of the overall grade distribution to ensure a good grade in the class.

**Take Home Exams:** There are 3 take home exams during the semester, each will focus on certain chapters, plus a take home final exam (all exams are mandatory). The final exam will not be cumulative in the traditional sense. Instead, all material in the course is cumulative (for example exam 2 is focused on chapters 5 and 6, but that does not mean you will not need information from chapters 1-4, likewise, though the final exam is focused on chapters 8-11 that does not mean you can forget everything from chapters 1-7 and chapter 13; though the final is focused on chapters 8-11, you might need information from all previous chapters on the final exam). Regular take home exams will be passed out on Monday and due the following Monday. **When an exam is distributed, you will also have homework due the following Monday as well.** See the exam and course schedule at the end of this document for topics covered on each exam. The take home final will be passed out during finals week at a time unanimously agreed upon by all participants. The take home final will span a 48-72 hour time slot at some point during finals week. Exams will be similar to the level of homework assignments, but you must work alone on these exams. **Any exam conflicts need to be brought to my attention at least 2 weeks before each exam (check the tentative schedule at the end of this document for all exam dates now, if you have known conflicts it is best to report them early).**

**Statement Regarding Students Requiring Special Accommodations & Students with Disabilities:** If you have any condition (physical, learning, or psychological) which will require any sort of special accommodations of any kind, such as testing accommodations, as soon as possible, please notify me immediately and contact the Office of Disability Services Program ([www.marshall.edu/disability](http://www.marshall.edu/disability)) or call 304-696-2467 to register and complete required documentation. Unfortunately, before accommodations can be given, I must receive official documentation; **therefore take care of this the first week of classes.**

**Attendance:** A new MU policy requires keeping attendance records for freshmen; thus, freshman will be required to sign in for every class period. Otherwise, attendance will not be taken as everyone in the class is an adult.

**Homework:** For your homework, always try it yourself first; however, you are encouraged (but not required) to discuss with your peers for help. Your peers will probably outnumber the number of the professors for this course ( $N=1$ ) and they may be more available than your professor to help you. I encourage students to discuss homework with each other if you arrive at different answers. If you think the answer you got is correct and you are confident in your solution, try and explain it to your fellow students, see what they think. Maybe they solved the problem a different way, arriving at a different answer, encouraging you to review and rethink how you solved the problem. Hopefully this encourages discussion of physics among you and your fellow students and builds your confidence in problem solving and improves your ability to explain your work to others. If you cannot get the required help from your peers, or simply have a question, simply see me during office hours, drop by anytime, or make an appointment with me, and/or apply for a tutor.

Also, keep in mind that acing the homework with a 100%, though homework is a significant portion of your grade (40% of the total grade) this will not be enough to allow you to pass if you do poorly on exams; thus, it is not beneficial to copy the homework each week from your peers without understanding it. Independent of whether you work in groups on your homework or individually and never collaborate with your fellow classmates, your performance and your performance alone is the determining factor that will allow you to pass the individual work alone exams (exams total 60% of the overall class grade). I expect everyone to put the time and effort in on the homework and to do very well on it (this is your grade padding), what will separate out the A, B, C, and D students will be individual exam performance. It is ill advised to continually ask your peers for help on the homework and then simply copy what they say without understanding the concepts or the detailed math behind the problem; you might get credit on the written homework, but this is a surefire way to fail the exams if you do not understand the concepts and math. Continually ask questions until you understand the concepts and the math, this is how to pass the exams.

**Written Homework:** 5-15 problems per week. These problems will be due on Monday each week (if the university is closed on Monday due to a holiday or weather, it will be due on Wednesday of that week). New problems will be given in return. Problems will still be due on Monday even if there is a take home exam that week. More points will be awarded for more difficult problems, total points per assignment may vary, and each assignment will have the same weight. The purpose of these written problems is to make sure you can clearly write out your thought process for someone to follow, showing all the details of your work and how you arrived at your final answer (you need to do this for exams, so written homework is the place to practice and get critiqued). In general, the best way to receive the most points on your written solution is to explain in words what quantity/variable you are solving for, in words explain how and what principles you are applying to solve for it, and show **ALL** the algebraic/advanced math steps and logic leading to a final equation that just contains symbols at first, no numbers. If numbers are given, only plug numbers into the final expression. Keep the correct units with all numbers and use appropriate significant figures and box your final answer. Solutions to homework will be given.

**Emergencies/Unexpectedly Missed an Exam or Unable to Turn in Homework:** Homework will be due on Mondays and exams will be due on certain Mondays. With the low enrollment numbers in this independent study, and exams being take home exams, I do not imagine this will be much of a problem; however, unexpected emergencies and accidents do happen. In any event, make email contact with me as soon as possible; you must give your reason for missing the exam/assignment in the email. A missed exam/assignment, with no prior email & no legitimate supporting documentation before or immediately after an exam/or when the homework is due, counts as a zero and cannot be made up. Makeup exams/assignments will be given only in very rare extraordinary circumstances all of which require legitimate documentation and may need approval from the Provost or Sr. VP or Dean of Student Affairs and/or the Dean of the College of Science. Approved and excused absences are determined by the Provost, Sr. VP, or Dean of Student Affairs. An "excused absence"- is a qualifying event for missing exams and unexpectedly not being able to turn in homework on the provided due date; examples are: extreme personal emergencies (house fires, serious crimes, and grave emergencies), university-sponsored activities, medical circumstances, death or critical illness of an immediate family member, short-term military obligations, jury duty, subpoenas for court appearance, etc. If an exam or homework is missed, and one of the above is the reason, I will need immediate legitimate documentation to verify the event in order to schedule a make-up exam/assignment. If you know in well in advance you will miss, notify me immediately. Also, notify me immediately when you arrive at a conflict. If you have to miss on Monday when homework and exams are due, plan to turn the work earlier (scan and email), not later. Late work is not accepted.

**Authorized vs Unauthorized Aid In Academic Work:** In this course, you are permitted to talk with other students about your homework problems and even encouraged to work together in groups on the homework, but you may not copy solutions verbatim from each other or answers from any other source. You must work the problems for yourself and understand them. Remember, 60% of your final grade is based on how you, and only you, can answer questions on the individual exams (Exams, 60%). Copying something and not understanding it does you no good now or later. If you have any questions about what constitutes authorized vs. unauthorized aid, contact me immediately. It is fairly easy to see when the same incorrect solutions are copied directly from the web year after year from unauthorized sources like chegg.com and cramster.com. If you are in doubt of what is an approved source, just ask me. When you use a source, you must cite it. **KEEP IN MIND, THOUGH ALLOWED TO WORK TOGETHER, DIRECT COPYING OF HOMEWORK FROM OTHERS IN THE CLASS OR FROM UN-APPROVED RESOURCES WILL NOT BE TOLERATED; BOTH ARE CONSIDERED ACADEMIC DISHONESTY.**

**Statement Defining Expectations for Student Conduct:** I will expect everyone in all portions of this course, including but not limited to meeting times, to act in a professional and courteous manner. Students are expected to conduct themselves in a manner that creates a productive learning environment for all members. To this end, disruptive, abusive, or offensive behavior directed at anyone involved in the course will not be tolerated. Disruptive behavior is any behavior that interferes with the normal conduct of the independent study that inhibits a productive learning. If you are experiencing, disruptive, abusive, or offensive behavior directed to you from others in the course (this includes when working together in homework groups if desired), please make me aware of the problem as soon as possible. In addition to acting professional and courteous in class, I only respond to emails that are written with professionalism and courtesy.

**University Policies:** By having the privilege of being enrolled in higher education and this course, you agree to all the University Policies and codes listed below. It is the student's responsibility to read the full text of each policy and code by going to [www.marshall.edu/academic-affairs](http://www.marshall.edu/academic-affairs) and clicking on "Marshall University Policies" or, you can access the policies directly by going to [www.marshall.edu/academic-affairs/policies/](http://www.marshall.edu/academic-affairs/policies/). The individual policies and codes are: Academic Dishonesty/Excused Absence Policy for Undergraduates/Computing Services Acceptable Use/Inclement Weather/Dead Week/Students with Disabilities/Academic Dismal/Academic Forgiveness/Academic Probation and Suspension/Affirmative Action/Sexual Harassment/Code of Student Rights and Responsibilities - also referred to as the Student Code of Conduct (<http://www.marshall.edu/student-affairs/files/15-16-Code-of-Conduct.pdf>).

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W #	Day	Date	Subjects From "Classical Mechanics" by John R. Taylor	Chapter - (Sections) Required Reading
1	M	August, 22	Chapter 1 - Scalars, Vectors, Transformation Matrix Review, and Newton's Laws of Motion	Ch.1 - (1-7)
2	M	August, 29	Chapter 2 - The Motion of Projectiles and Charged Particles	Ch.2 - (1-7)
3	M	September, 5	<i>University Holiday - Labor day</i>	
4	M	September, 12	Chapter 3 - Momentum and Angular Momentum	Ch.3 - (1-5)
5	M	September, 19	Chapter 4 - Energy	Ch.4 - (1-10)
6	M	September, 26	Chapter 5 - Oscillations	Ch.5 - (1-6)
		<b>Exam 1</b>	<b>Passed Out on Monday, September, 26th, Collected on Monday, October 3rd</b>	<b>Covers Chapters (1-4)</b>
7	M	October, 3	Chapter 6 - Calculus of Variations	Ch.6 - (1-4)
8	M	October, 10	Chapter 7 - Lagrange's Equations (October, 10th, Freshmen/Sophomore Midterm Grades Due)	Ch.7 - (1-7)
9	M	October, 17	Chapter 7 - Lagrange's Equations	Ch.7 - (8-10)
		<b>Exam 2</b>	<b>Passed Out on Monday, October 17th, Collected Start of Class on Monday, October 24th</b>	<b>Covers Chapters (5 &amp; 6)</b>
10	M	October, 24	Chapter 13 - Hamiltonian Mechanics (October 28th - Last Day to Drop a Course)	Ch.13 - (1-4)
11	M	October, 31	Chapter 13 - Hamiltonian Mechanics	Ch.13 - (5-7)
12	M	November, 7	Chapter 8 - Two Body Central Force Problems	Ch.8 - (1-8)
		<b>Exam 3</b>	<b>Passed Out on Monday, November 7th, Collected Start of Class on Monday, November 14th</b>	<b>Covers Chapters (7 &amp; 13)</b>
13	M	November, 14	Chapter 9 - Mechanics in Noninertial Frames	Ch.9 - (1-10)
	M	November 21-27	<i>University Holiday - Thanksgiving Break</i>	
14	M	November, 28	Chapter 10 - Rotational Motion of Rigid Bodies	Ch.10 - (1-8)
15	M	December, 5	Chapter 11 - Coupled Oscillators and Normal Modes	Ch.11 - (1-6)
<b>Final Exam: 48-72 Hour Take Home Exam During Finals Week- Time Agreed Upon by All Participants</b>				<b>Chapters (8-11)</b>

Version 2.0 This is a tentative schedule and syllabus; guidelines, rules, policies, and due dates can be subject to change at any time throughout 8/11/2016 the semester. We will try to stick as close to the policies and schedule presented here.