Univ. of Winnipeg Dept. of Physics
Fall 2019

PHYS-3202 Intermediate Mechanics

Lecture Times: MWF 10:30-11:20AM Room: 4M46

Instructor: Dr. Andrew Frey
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Office Hours: T 1:00-2:00PM or by appointment

Course Description

This course provides a 3D vector treatment of Newtonian mechanics with an emphasis on conservation principles.

Textbooks

There is one required text, but the lectures will refer to several others extensively. These texts are available on reserve at the library.

- **Required**: *Classical Mechanics* by Kibble and Berkshire, 5th ed
- **Supplementary**: *Analytical Mechanics* by Fowles and Cassiday, 7th ed
- **Supplementary**: *Classical Mechanics* by Taylor
- **Supplementary**: *Classical Dynamics of Particles and Systems* by Thornton and Marion, 5th ed

In addition, some extra reading (from other texts, journal articles, etc) may be assigned.

Topics

We will discuss

- Newton's Laws, Basic Assumptions, Dimensional Analysis
- Linear Motion — Potential Energy — Energy and Momentum Conservation — Friction and Air Resistance — Harmonic Oscillators — Propulsion — Collisions — ODEs in Mechanics
- 3D Motion — Vector Calculus Review — Examples — Conservative Forces — Angular Momentum and Torque — Central Forces — Orbits — Collisions and Cross Sections
- Rotating (Noninertial) Frames — Changing Frames — Centrifugal and Coriolis Forces
- Rigid Body Rotation — Moment of Inertia Tensor — Principal Axes — Rotation Around Axis — Free Rotation — Precession and Nutation — Euler Angles
- Potentials — Spherical Distributions — Potential Expansion — Shape of the Earth — Tides

Not all topics above will be covered equally. Also, some topics may be skipped due to time constraints or taught in different orders.

Teaching Outcomes: By the end of the course, you should have a conceptual and quantitative understanding of the above topics. Through the homework assignments, you should also gain experience with using differential equations, approximation methods, and computational resources (particularly Maple software) in physics. You will also learn how to write a short physics paper.

Assignment Policies

Reading: Reading assignments will be posted on the course web page each week (usually 3-6 sections per week). You are responsible for keeping up with the reading; material covered in the reading will not necessarily be discussed in the class lectures but may be relevant to assignments.

Homework: Assignments will be posted on the course web page (see above) in PDF format each Wednesday. They will **NOT** be handed out in class, so you must tell me if you cannot access the assignments! The assignment will then be due at 10:59PM on the listed due date in the labeled dropbox outside room 2L26; make sure to mark your paper with your name and "IMech." Alternately, homework can be emailed to the instructor as black-and-white scanned (*not photographed*) PDF or a PDF prepared with LaTeX software. Homework solutions will be posted on the course web page as soon as possible after assignments have been collected. Collaboration on the problems is allowed, but each student must write up the solutions independently. Late assignments will **not** be accepted without prior permission from the instructor. Some assignments will require the use of Maple software, which is available on the computers in room 2L14.

Class Project: Students will write a short paper on a subject related to but not necessarily included in the course topics listed above. This typed report will include a review of the concept and a quantitative (analytical or numerical) description of the relevant physics. Students may work on their own or in groups of 2 or 3; the amount of work required will scale with the size of the group. Detailed instructions will be provided in the course meeting following the in-class test.

Exams: No electronic equipment is allowed during either the in-class test or the final exam, except at the discretion of the instructor. Students should be prepared to present identification at tests and exams.

Religious Holidays: You may choose not to attend class or write tests/examinations on holy days of your religion, but you must notify me at least two weeks in advance. If so, I will provide the opportunity to make up work without penalty.

Organization: Your homework and exam solutions should be written (or typed) neatly with steps explained *as if you were writing a research paper or lab report.* Not all algebra need be shown if the steps are explained in words; however, showing your work may improve your credit if you make a mistake. Homework that is not neatly organized and written will not be graded and will be given **zero credit** (one warning will be allowed). In addition, multiple pages must be stapled together.

Regrading: If you feel that there is a mistake in grading, I will regrade each problem in question completely. It is possible that newly discovered mistakes will reduce your credit. Please also see the section on appeals.

Evaluation

Grades: Course grades will be comprised of the following components:

- Homework Assignments: 40%
- In-Class Test: 15%
- Class Project: 15%
- Final Exam: 30%

Guidelines for the assignment of numerical percentage grades to letter grades are as follows:

- A+ = 95-100%
- A = 87-94%
- A- = 80-86%
- B+ = 74-79%
- B = 67-73%
- C+ = 61-66%
- C = 53-60%
- D = 50-52%
- F = 0-49%

Note that these are guidelines. Final grades shall be approved by the Department Review Committee and may be subject to change.

Exam & Other Important Dates: Dates to note include

- First Lecture: Sept 4,2019
- Fall Reading Week: Oct 13-19, 2019
- In-Class Test: mid-Oct, 2019
- Rememberance Day Holiday: Nov 11, 2019
- Voluntary Withdrawal Date: Nov 12, 2019 (without academic penalty)
- Last Regular Lecture: Dec 2, 2019
- Remembrance Day Make-Up: Dec 3, 2019
- Course Project Due: Dec 4, 2019
- Final Exam: Dec 6, 2019, 9AM-12PM (subject to university scheduling)

Appeals and Misconduct: See the **Regulations and Policies** section of the **Academic Calendar** (`https://uwinnipeg.ca/academics/calendar/docs/regulationsandpolicies.pdf`) regarding appeals and

academic misconduct. Pay attention to subsections 8, 9, and 10 and Discipline with respect to plagiarism and other cheating. Note that use of solutions from other courses, previous years, or from the textbook publisher will be considered cheating, and uploading assignments to filesharing sites will be considered aiding and abetting plagiarism. More information can be found at `https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-policy.pdf`, `https://www.uwinnipeg.ca/institutional-analysis/docs/policies/academic-misconduct-procedures.pdf`, `https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-policy.pdf`, and `https://www.uwinnipeg.ca/institutional-analysis/docs/student-non-academic-misconduct-procedures.pdf`. See also `https://www.youtube.com/watch?v=UvFdxRU9a8g`.

Miscellaneous

Emails: I may at times need to communicate with the class as a whole via email, which may be through your official university email address. Please check that account as well as your preferred account.

Avoiding Copyright Violation: Course materials are owned by the instructor who developed them. Examples of such materials are course outlines, assignment descriptions, lecture notes, test questions, and presentation slides. Students who upload these materials to filesharing sites, or in any other way share these materials with others outside the class without prior permission of the instructor/presenter, are in violation of copyright law and University policy. Students must also seek prior permission of the instructor /presenter before photographing or recording slides, presentations, lectures, and notes on the board.

Accessibility Services: Students with documented disabilities, temporary or chronic medical conditions, requiring academic accommodations for tests/exams (e.g., private space) or during lectures/laboratories (e.g., note-takers) are encouraged to contact Accessibility Services (AS) at 204-786-9771 or accessibilityservices@uwinnipeg.ca to discuss appropriate options. All information about a students disability or medical condition remains confidential. `http://www.uwinnipeg.ca/accessibility`.

Data Collection: Students who plan to conduct research interviews, focus groups, surveys, or any other method of collecting data from any person, even a family member, must obtain the approval of the appropriate ethics committee before commencing data collection. Exceptions are research activities in class as a learning exercise. See `http://www.uwinnipeg.ca/research/human-ethics.html` for submission requirements and deadlines.

Respectful Working and Learning Environment Policy: All students, faculty, and staff have the right to participate, learn and work in an environment that is free of harassment and discrimination. The UW Respectful Working and Learning Environment Policy may be found online at `http://www.uwinnipeg.ca/respect`.