For many of you, this will be your first “real” course in Newtonian dynamics. We will treat \( \ddot{\mathbf{r}} = m\mathbf{a} \) properly, as the vector differential equation it is, and study the dynamics of particles and systems of particles, and associated conservation laws. We will also study oscillating systems—perhaps the single most important system in all of physics. In addition, we will study Newtonian gravity and planetary orbits—arguably the greatest triumph of Newtonian dynamics. Finally, we will learn some of the fascinating ways in which Newtonian dynamics was modified in light of Einstein’s special theory of relativity. In the course of our studies we will also be learning to “think like a physicist.” Physics is not about memorizing formulas and plugging in numbers. At the level of this course, physics is about understanding a few simple but powerful principles, and practicing the art of applying these principles to gain deeper insights into a wide variety of interesting physical situations.

**Instructor:** Dr. Richard Epp  
**Email:** rjepp@uwaterloo.ca  
**Office:** Physics 241  
**Office Hours:** Tue 11:30 – 1:00 / Thursday 2:30 – 4:00, or email/drop by my office anytime

**TA:** The names, contact info, and office hours of the TAs will be given on LEARN during the first week  
**Note:** Contact the TAs first for any questions regarding *marking* of the weekly problem sets

**Lectures:** Tue/Thu 10:00 – 11:20 am in MC 4020

**Textbook:** *Classical Dynamics of Particles and Systems* 5th Ed. by Thornton & Marion (optional but recommended)

**Other Materials:** Lecture notes, weekly problem sets & solutions, course announcements, etc., will be posted on UW LEARN

**Topics:** We will cover most of chapters 1, 2, 3, 5, 8, 9, 14, but not necessarily in the chapter/section order given in the textbook. Please attend the lectures and study the lecture notes (your own and/or the posted lecture notes), and augment this with a study of the relevant textbook sections.

**Assessment:**
1. 25%: Weekly problem sets (posted Fridays; due in class the Tuesday after the following Friday)  
2. 25%: Midterm test  
3. 50%: Final exam (you must pass the final exam to pass the course)

**Course Outline:**
1. Introduction to classical mechanics  
2. Review of vectors and kinematics  
3. Newtonian dynamics and conservation laws  
4. Newton’s universal law of gravitation  
5. Dynamics of a system of particles  
6. Two-body central force problem and orbital dynamics  
7. Oscillating systems  
8. Einstein’s special theory of relativity
The Fine Print

Work Expected:
1. Attend lectures and take appropriate notes. You are responsible for everything presented.
2. Study the lecture notes (yours and the posted notes), plus the relevant sections of the textbook.
3. Complete and submit the weekly problem sets on time.
4. Sit the midterm test and final exam.

The weekly work-load for the course should be 3 hours of lectures, about 3 hours of studying, and about 3 hours of assignment work. Students should also check the UW LEARN course website regularly for course announcements.

Notes on Problem Sets:
1. Collaboration and/or discussion with other students are allowed on the problem sets, but make sure you understand what you are doing; the test and exam are not group efforts! If you are working with others please indicate this on the work you hand in.
2. The problem sets are posted on Fridays and are to be submitted in class the Tuesday after the following Friday (one week plus two weekends). They will be graded and handed back in class. It is strongly recommended that you study the posted solutions.

UW Regulations on missed Assignments, Midterm Test and Final Exam:
The University of Waterloo Verification of Illness Form (VIF) is normally the only acceptable medical documentation of illness.

1. Missed due dates: Normally, the weighting of the missed assignment is added to the final examination weighting or spread over the remaining assignments. Assignment due dates are not extended.
2. Term tests: Normally, the weighting of the missed test is added to the final examination weighting or spread over the remaining tests. Term tests are not deferred.
3. Final Examinations: The faculty of Science usually offers one or two opportunities shortly after the exam period for students to write a deferred final exam due to illness.

Drop-dates:
Students concerned about the level of the course, course requirements, or their performance should keep in mind cut-off dates for dropping courses without penalty.
Academic integrity, grievance, discipline, appeals and note for students with disabilities:

[The following statements MUST be included in all course outlines and/or websites.]

**Academic integrity**: In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

**Grievance**: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department’s administrative assistant who will provide further assistance.

**Discipline**: A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

**Appeals**: A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.

**Note for students with disabilities**: AccessAbility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

**Turnitin.com and alternatives**: Plagiarism detection software (Turnitin) will be used to screen assignments in this course. This is being done to verify that use of all material and sources in assignments is documented. In the first week of the term, details will be provided about the arrangements for the use of Turnitin and alternatives in this course.

Note: students must be given a reasonable option if they do not want to have their assignment screened by Turnitin. See Academic Integrity - Guidelines for Instructors for more information.