PHYS 3220: Classical Mechanics I – Fall 2025
Slot 02, Monday/Wednesday/Friday: 9:00-9:50
Lecture Room: C-2045

Prerequisites
PHYS 2820 and MATH 2260

Instructor
Dr. Iakov (Yakov) Afanassiev, Office: C-4065. The best way to reach me is by email on D2L/Brightspace
Office hours: Anytime
Course web page: on D2L/Brightspace

Textbook
Classical Mechanics by John R. Taylor

Evaluation Scheme

Assignments (approx. 5), altogether worth 30% of the total mark;

- All assignments are to be handed in at the beginning of class of the day the assignment is due.
- No assignment will be accepted after the assignment solutions have been given out or the solutions have been covered in class. It is the responsibility of the student to ensure his/her assignment is handed in at the proper time.
- Many assignments will require plots/graphs to be made by a computer. Any of the following programs will suffice: Python, Excel, Grapher, Mathematica, Maple, Matlab

Mid-term 50-min test, worth 25% of the total mark, scheduled for Wednesday, October 22;

- There will be no supplementary midterm.
- The midterm will be closed book

2-hour Final exam, worth 45% of the total mark.

- The date and time of the final exam will be decided and posted by the university administration. It is the responsibility of the student to find out when and where the final exam will be held.
- Students are permitted to bring one page (both sides) of aids to memory (formulae, etc) into the final examination (but not into the mid-term test).

Note that original work, completed wholly by you, is expected to be submitted in this course. The use of an AI tool like **ChatGPT is not permitted**.

Note that according to University Regulation 6.7.5

> *"A student who is prevented from completing a part of the evaluation by illness of at least five calendar days' duration, bereavement or other acceptable cause, duly authenticated in writing, may apply for an alternate evaluation…"*

The alternate evaluation is offered in the form of an alternative allocation of marks.

Outline

1) Review of Vector geometry and Newton's Law of Motion
   - Units
   - Scalars and Vectors
   - Vector Operations
   - Coordinate Transformations
   - Derivative of Vectors

- Fundamental Concepts of Physics
- Newton's Laws of Motion
- Momentum
- Differential Equations
- Alternative Coordinate Systems

2) Projectile Motion and Resistance
   - Air Resistance
   - Linear Air Resistance – Horizontal and Vertical Motion
   - Quadratic Air Resistance – Horizontal and Vertical Motion
   - Terminal Velocity

3) Momentum and Angular Momentum
   - Conservation of Momentum
   - Rockets
   - Center of Mass Systems
   - Angular Momentum
   - Moment of Inertia

4) Energy
   - Kinetic Energy and Work
   - Potential Energy and Conservative Forces
   - Forces as the Gradient of Potential Energy
   - Time Dependent Potential Energy
   - Energy for One-Dimensional Systems
   - Curvilinear One-Dimensional Systems
   - Central Forces
   - Energy of Interacting Particles
   - Energy of a Multiparticle System.

5) Oscillations
   - Hooke's Law
   - Simple Harmonic Motion
   - Two-Dimensional Oscillators
   - Damped Oscillations
   - Driven Damped Oscillations
   - Resonance
   - Fourier Series
   - Fourier Series Solutions for the Damped Oscillator.
6) Calculus of Variations
   - Euler-Lagrange Equation
   - Applications of the Euler-Lagrange Equations
   - More than two variable systems

7) Lagrange's Equation
   - Lagrange's Equation for Unconstrained Motion
   - Constrained Systems
   - Examples of Lagrange's Equations
   - Generalized Momenta and Ignorable Coordinates
   - Conservative Laws

8) Two Body Central Force Problems[1]
   - Center of Mass and Relative Coordinates; Reduce Mass
   - The Equations of Motion
   - The Equivalent One-Dimensional Problem
   - The Equation of the Orbit
   - The Kepler Orbit
   - The Unbounded Kepler Orbit.

Important general information from the University

[1] The subject covered in this chapter will be dependent on available time.

As a MUN student, it is your responsibility to acquaint yourself with the following information:

Missed work : Students who cannot complete labs, assignments, or mid-term tests need to consult the University Calendar, Section **6.7.5 Exemptions from Parts of the Evaluation,** and speak to the instructor.

3. Student Code of Conduct: http://www.mun.ca/student/conduct/

6.8.2 Exemptions From Final Exams : http://www.mun.ca/regoff/calendar/sectionNo=REGS-0628

6.12 Academic Misconduct : http://www.mun.ca/regoff/calendar/sectionNo=REGS-0748

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are provided in a timely manner. You can contact Accessibility Services (Blundon Centre) by emailing blundon@mun.ca.