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| **ORIGINAL COURSE IMPLEMENTATION DATE:** | June 1993 |
| **REVISED COURSE IMPLEMENTATION DATE:** | January 2021 |
| **COURSE TO BE REVIEWED** (six years after UEC approval)**:** | October 2026 |

Course outline form version: 05/18/2018

# OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

**Note: The University reserves the right to amend course outlines as needed without notice.**

**Course Code and Number:** PHYS 221

**Number of Credits:** 4 Course credit policy (105)

**Course Full Title:** Intermediate Mechanics

**Course Short Title:**

*(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)*

**Faculty:** Faculty of Applied and Technical Studies

**Department (or program if no department):** Physics

**Calendar Description:**

This intermediate mechanics course covers polar co-ordinates, orbits, dynamics of solid bodies, driven damped oscillators, and coupled oscillators.

**Prerequisites (or NONE):** (PHYS 111 and PHYS 112) or (PHYS 101 and PHYS 105 with a B+ or higher in each).

**Corequisites (if applicable, or NONE):**

**Pre/corequisites (if applicable, or NONE):** MATH 211.

**Antirequisite Courses** *(Cannot be taken for additional credit.)*

Former course code/number:

Cross-listed with:

Dual-listed with:

Equivalent course(s): *(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)*

**Typical Structure of Instructional Hours**

| | |
|---|---|
| Lecture/seminar hours | 75 |
| Tutorials/workshops | |
| Supervised laboratory hours | 30 |
| Experiential (field experience, practicum, internship, etc.) | |
| Supervised online activities | |
| Other contact hours: | |
| **Total hours** | **105** |

Labs to be scheduled independent of lecture hours: ☐ No ☒ Yes

**Special Topics** *(Double-click on boxes to select.)*

This course is offered with different topics:

☒ No ☐ Yes *(If yes, topic will be recorded when offered.)*

**Independent Study**

If offered as an Independent Study course, this course may be repeated for further credit: *(If yes, topic will be recorded.)*

☒ No ☐ Yes, repeat(s) ☐ Yes, no limit

**Transfer Credit**

Transfer credit already exists: *(See **bctransferguide.ca**.)*

☐ No ☒ Yes

Submit outline for (re)articulation:

☐ No ☐ Yes *(If yes, fill in transfer credit form.)*

**Grading System**

☒ Letter Grades ☐ Credit/No Credit

**Maximum enrolment (for information only):** 24

**Expected Frequency of Course Offerings: Annually**

Annually *(Every semester, Fall only, annually, etc.)*

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|---|---|---|
| **Department / Program Head or Director:** Norm Taylor | **Date approved:** | September 1, 2019 |
| **Faculty Council approval** | **Date approved:** | November 1, 2019 |
| **Dean/Associate VP:** John English | **Date approved:** | November 1, 2019 |
| **Campus-Wide Consultation (CWC)** | **Date of posting:** | February 21, 2020 |
| **Undergraduate Education Committee (UEC) approval** | **Date of meeting:** | October 2, 2020 |

**Learning Outcomes:**

Upon successful completion of this course, students will be able to:

- Identify the relevant physics in mechanical systems.
- Create mathematical models of oscillating mechanical systems.
- Justify their mathematical models and be aware of their limitations
- Solve the mathematical models of mechanical systems to predict their future behavior.
- Describe their results clearly to others.
- Collect and analyze data on physical systems, contrasting them with model predictions.

**Prior Learning Assessment and Recognition (PLAR)**

☒ Yes ☐ No, PLAR cannot be awarded for this course because

**Typical Instructional Methods** *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

This course will be presented using lectures and laboratory experiments. Demonstrations and audio-visual aids will be used whenever appropriate. Problem sets will be assigned and graded for each chapter studied.

**NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.**

**Typical Text(s) and Resource Materials** *(If more space is required, download Supplemental Texts and Resource Materials form.)*

| | Author (surname, initials) | Title (article, book, journal, etc.) | Current ed. | Publisher | Year |
|---|---|---|---|---|---|
| **1.** | Fowles & Cassiday | Analytical Mechanics, 7th ed. | ☒ | Brooks/Cole | 2004 |
| **2.** | Alonso & Finn | Fundamental University Physics, Vol. I | ☒ | | |
| **3.** | A.P. French | Newtonian Mechanics | ☒ | | |
| **4.** | Halliday & Resnick | Physics, Part I | ☒ | J. Wiley | |
| **5.** | Kleppner & Kolenkow | An Introduction to Mechanics | ☒ | McGraw-Hill | |
| **6.** | A. Douglas Davis | Classical Mechanics | ☒ | Academic Press | |

**Required Additional Supplies and Materials** *(Software, hardware, tools, specialized clothing, etc.)*

**Typical Evaluation Methods and Weighting**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Final exam: | 45% | Assignments: | 10% | Field experience: | % | Portfolio: | % |
| Midterm exam: | 25% | Project: | % | Practicum: | % | Other: | % |
| Quizzes/tests: | 10% | Lab work: | 10% | Shop work: | % | Total: | 100% |

**Details (if necessary):**

**Typical Course Content and Topics**

- Kinematics: motion in one and two dimensions; dissipative forces; forces as function of time, position, and velocity
- Harmonic oscillator: simple harmonic oscillator, power series representation of an arbitrary function, damped and forced oscillators
- Vectors: vector algebra, vector multiplication, coordinate systems, vector calculus, vector differential operators
- Coordinate systems: plane polar coordinates, cylindrical coordinates, spherical coordinates, moving and rotating coordinate systems, vector differential operators in spherical and cylindrical coordinate systems
- Central forces: potential energy and central forces, angular momentum and central forces, inverse square law and ellipses, Kepler's laws
- Rigid bodies: centre of mass, angular momentum, rotation about a fixed axis, moment of inertia, conservation of energy and momentum
- Systems of particles: momentum, momentum with variable mass (including rockets), collisions, centre of mass

**Laboratory experiments:**

1. Dissipative forces (F, v) (two lab periods)
2. Anharmonic motion (two lab periods)
3. Damped harmonic motion
4. Coupled harmonic motion
5. Forced damped oscillations
6. Compound pendulum
7. Moment of inertia of complex symmetric shapes