PHYS-201 – Analytical Mechanics

University Arts and Science

Effective Term & Year: Fall 2022
Course Outline Review Date: 2026-09-01

Program Area: Math and Sciences

Description:

Analytical Mechanics involves advanced applications of Newton's Laws and rotational motion. This course also covers non-inertial reference frames, central forces, and Kepler's Laws of Motion.

Program Information:

This course is required for Physics, Engineering and Math Majors. This course is usable for Associate of Arts and Associate of Science degrees.

Delivery Methods: On-campus (Face-to-Face)

Credit Type: College of the Rockies Credits

Credits: 3

Course type/s: Lab Sciences, Sciences

Instructional Activity and Hours:

Activity	Hours
Classroom, Directed Studies or Online Instruction	45
Seminar/Tutorials	
Laboratory/Studio	45
Practicum/Field Experience	
Co-op/Work Experience	

Other	
Total	90

Course Requisites:

- Complete all of the following
  - Completed the following:
    - PHYS104 – Introduction to Physics 2 (3)
    - MATH104 – Integral Calculus (3)
  - Completed or concurrently enrolled in:
    - MATH201 – Multivariable Calculus (3)

Flexible Assessment: Yes

In some cases students may be able to apply for recognition of prior learning outside the classroom. This flexible assessment process provides equivalent course credit. It is a rigorous process that may include external evaluation, worksite assessment, demonstration, standardized test, self-assessment, interview, products/portfolio, and challenge exam, or other measures as appropriate. Tuition fees apply. Contact an education advisor for more information.

Course Transfer Credit:

For information about receiving transfer credit for courses taken at either British Columbia or Alberta institutions, please see https://www.bctransferguide.ca/ or https://transferalberta.alberta.ca . For more transfer credit information, please visit https://www.cotr.bc.ca/Transfer

All requests for course transfer credit from institutions in British Columba or elsewhere should go to the College of the Rockies Enrolment Services office.

Textbook Resources:

Textbook selection varies by instructor and may change from year to year. At the Course Outline Effective Date the following textbooks were in use:

Taylor, *Classical Mechanics*, University Science Books (2005)

Please see the instructor's syllabus or check COTR's online text calculator https://textbook.cotr.bc.ca/ for a complete list of the currently required textbooks.

Learning Outcomes:

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

- model the acceleration of a system of interconnected parts involving lateral or rotational motion;
- calculate the moment of inertia for an extended object around a given axis of rotation;
- describe the use of differential equations and initial conditions as it relates to modelling dynamic systems;
- use complex functions to solve the differential equations relating to damped and/or driven harmonic oscillators;
- describe the different ways a damped and/or driven harmonic oscillator will behave depending on its specific physical parameters;
- recognize and use conserved quantities to simplify the analysis of a dynamic system;
- derive the conservation of angular momentum in a dynamic system involving a single central force;
- convert the description of motion from a Cartesian coordinate system to a Polar coordinate system;
- list the three Kepler’s laws, and describe how they are related to Newton’s Universal law of gravitation;
- use conservation laws and Newton’s Universal law of gravitation to classify orbits according to the total energy of the system; and
- define a pseudo-force and recognize two pseudo-forces from a rotating reference frame.

Course Topics:

- Newton’s laws and rotational motion
- Analyzing systems relating more than one type of motion
- Universal Gravitation
- Using differential equations to describe dynamic systems
- Driven and damped simple harmonic motion
- Conservative Forces
- Central Forces
- Motion in Polar coordinates
- Coordinate transformations
- Noninertial reference frames and pseudo forces

See instructor’s syllabus for the detailed outline of weekly readings, activities and assignments.

Evaluation and Assessments

Assessment Type: On-Campus (face-to-face)

Assessment Type	% of Total Grade
Assignments	20%
Laboratory	20%
Midterms	20%
Final Exam	40%
Total	100%

Grade Scheme

A+	A	A-	B+	B	B-	C+	C	C-	D	F
>=90	89-85	84-80	79-76	75-72	71-68	67-64	63-60	59-55	54-50	<50

Evaluation Notes: A grade of “D” grants credit, but may not be sufficient as a prerequisite for sequential courses.

Evaluation Notes Comments:

Please see the instructor’s syllabus for specific classroom policies related to this course, such as details of evaluation, penalties for late assignments and use of electronic aids.

Exam Attendance:

Students must attend all scheduled exams at the appointed time and place. Instructors may approve an alternate exam to accommodate an illness or personal crisis. Department heads will consider other written requests. Any student who misses a scheduled exam without prior approval will receive a “0” on the exam.

Academic Policies:

College of the Rockies policies related to courses can be found at https://cotr.bc.ca/about-us/college-policies/ and include the following:

- Policy 2.4.3 Students with Documented Disabilities
- Policy 2.4.4 Student Conduct (plagiarism, other cheating, behavioral misconduct)
- Policy 2.5.8 Academic Performance
- Policy 2.5.3 Grade Appeal
- Policy 2.4.9 Student Concerns Re Faculty

Course Changes:

The College of the Rockies updates course outlines regularly to meet changing educational, employment and marketing needs. The instructor will notify students in writing of any updates to this outline during the semester. The instructor reserves the right to revise, add or delete material while meeting the learning outcomes of this course outline.