

UNIVERSITY OF CALGARY
FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS AND ASTRONOMY
COURSE OUTLINE

1. Course: PHYS 609 Advanced Classical Mechanics Winter 2017

Instructor: Dr. David Hobill | SB 539 | (403) 220-6965 |
email: hobill@ucalgary.ca
Office Hours: W 10:00-11:00, R 16:00-17:00

Lecture Sections: LEC 1 | TR 09:30-10:45 | ENF 334

Course Website: d2l.ucalgary.ca

Departmental Office: SB 605, 403-220-5385, phasugrd@ucalgary.ca

2. Prerequisites: Background should include Physics 343 and or equivalent.

Note: The Faculty of Science policy on pre- and co-requisite checking is outlined in the 2015-2016 Calendar. A student may not register in a course unless a grade at least "C-" has been obtained in each pre-requisite course; it is the responsibility of students to ensure that their registrations are in order. See <http://www.ucalgary.ca/pubs/calendar/current/sc-3-5.html> for details.

3. Grading: The University policy on grading and related matters is described sections [F.1](#) and [E.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments: 35%
Midterm Exam: 25% (mid Feb, during regular class hours)
Final Exam: 40% (To be scheduled by the Registrar)

Percentage to letter grade conversion scale:

> = 97 %	A +	> = 77 %	B +	> = 62 %	C +	> = 49 %	D +
> = 87 %	A	> = 72 %	B	> = 57 %	C	> = 46 %	D
> = 82 %	A -	> = 67 %	B -	> = 52 %	C -	< 46 %	F

4. Missed Components of Term Work: The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize himself/herself with these regulations. See also [Section E.6](#) of the University Calendar.

5. Scheduled out-of-class activities: Dates and times of approved class activities held outside of class hours.

REGULARLY SCHEDULED CLASSES HAVE PRECEDENCE OVER ANY OUT-OF-CLASS-TIME-ACTIVITY. If you have a clash with this out-of-class-time-activity, please inform your instructor as soon as possible so that alternative arrangements may be made for you.

6. Course Materials: *Classical Mechanics*, Goldstein, Poole and Safko, 3rd edition, Addison-Wesley

Online Course Components: Assignments, and supporting lecture material will be posted on the course D2L website.

7. Examination Policy: Both the midterm and final examinations will be closed book. No calculators or laptops will be allowed. Students should also read the Calendar, [Section G](#), on Examinations.

8. Approved Mandatory and Optional Course Supplemental Fees: None

9. Writing across the curriculum statement: In this course, the quality of the student's writing in homework assignments will be a factor in the evaluation of those assignments. See also [Section E.2](#) of the University Calendar.

10. Human studies statement: Students in the course will not be expected to participate as subjects or researchers. See also [Section E.5](#) of the University Calendar.

11. OTHER IMPORTANT INFORMATION FOR STUDENTS:

(a) Misconduct: *Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties.*

(b) Assembly Points: In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).

(c) Student Accommodations: Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf. Students needing an Accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics and Astronomy, Dr. David Feder, by email (dfeder@ucalgary.ca) or by phone (403.220.3638).

(d) Safewalk: Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 2205333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) Freedom of Information and Privacy: This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). As one consequence, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information see also <http://www.ucalgary.ca/secretariat/privacy>.

(f) Student Union Information: [VP Academic](#) Phone: 220-3911 Email: suvpaca@ucalgary.ca.
SU Faculty Rep: Phone: 220-3913 Email:
science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca
Student Ombuds Office: 403 220-6420 Email:
ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>

(g) Internet and Electronic Device Information: You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

(h) U.S.R.I.: At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

12. OTHER COURSE RELATED INFORMATION:

(a) Course Description

Variational principles, Lagrange's equations, Noether's theorem. Hamilton's equations and canonical transformations. Hamilton-Jacobi theory, action-angle variables.
Perturbation theory.

(b) Course Learning Outcomes

An understanding of the theory and applications of variational principles,

Implementation of symmetries and Noether's theorem

Hamiltonian methods and its extensions

Relationship between classical mechanics quantum mechanics

(c) Course Learning Incomes

Solutions to ordinary and partial differential equations

A knowledge of vector algebra and calculus

Harmonic motion and central forces

Fundamentals of rotational motion and angular momentum

(d) Syllabus

Topics to be covered in this class are:

1. Review of Newtonian Mechanics: mathematical formulation, equations of motion, phase space, conservation laws

2. Lagrangian formalism: constraints, generalized coordinates, virtual displacements, principle of virtual work, d'Alembert's principle, Lagrange's equations, generalized potential, Lagrange multipliers

3. Variational principles: action integral, Hamilton's principle, calculus of variations, Euler-Lagrange equation

4. Noether's theorem and symmetries: conservation laws, cyclic variables

5. Hamiltonian formalism: Legendre transformation, Hamilton's equations, symplectic notation, Routh's procedure, modified Hamilton's principle, action principles, Liouville's theorem, Poincare recurrence theorem, Poisson brackets

6. Canonical transformations: generating functions, symplectic approach, infinitesimal canonical transformations

7. Hamilton-Jacobi formalism: Hamilton-Jacobi equation, Hamilton's principle function, Hamilton's characteristic function, separability, action-angle variables

8. Connection between classical & quantum mechanics (time permitting)

9. Canonical perturbation theory (time permitting)

10. Classical field theory (time permitting)

Department
Approval _____

Date _____