ORIGINAL COURSE IMPLEMENTATION DATE:	June 1993
REVISED COURSE IMPLEMENTATION DATE:	September 2016
COURSE TO BE REVIEWED: (six years after UEC approval)	October 2021

Course outline form version: 07/07/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

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

Course Code and Number: PHYS 321 **Number of Credits: 3** Course credit policy (105)

Course Full Title: Advanced Mechanics

Course Short Title (if title exceeds 30 characters):

Faculty: Faculty of Science **Department (or program if no department):** Physics

Calendar Description:

Motion in non-inertial reference frames, calculus of variations and Lagrange's equations with and without constraints, Hamilton's equations, rotational moment of inertia, motion of rigid bodies in three dimensions, the symmetric top.

Prerequisites (or NONE):	PHYS 221.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	PHYS 381/MATH 381/ENGR 257.

Equivalent Courses (cannot be taken for additional credit)

Former course code/number: **n/a**

Cross-listed with:

Equivalent course(s):

Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit

Transfer credit already exists: ☐ Yes ☒ No

Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)

Resubmit revised outline for articulation: ☐ Yes ☐ No

To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 75

Typical structure of instructional hours:

Lecture hours	75
Seminars/tutorials/workshops	
Laboratory hours	
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**75**

Special Topics

Will the course be offered with different topics?
☐ Yes ☒ No

If yes, different lettered courses may be taken for credit:
☐ No ☐ Yes, repeat(s) ☐ Yes, no limit

Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 24

Expected frequency of course offerings (every semester, annually, every other year, etc.): Once every 2-3 yrs

Department / Program Head or Director: Derek Harnett	**Date approved:**	December 2, 2014
Campus-Wide Consultation (CWC)	**Date of posting:**	August 14, 2015
Faculty Council approval	**Date approved:**	January 2015
Dean/Associate VP: Lucy Lee	**Date approved:**	January 2015
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	October 2, 2015

Learning Outcomes

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

Apply Coriolis, centrifugal, and azimuthal forces in the analysis of physical systems in which the observer is accelerating.
Derive the Euler-Lagrange equations.
Solve systems of equations (with and without constraints) using the Lagrangian approach
Compute forces of constraint within the Lagrangian formalism.
Apply Hamilton's equations to simple systems.
Analyze a wide variety of two dimensional rotational motion problems.
Calculate the inertia tensor for a three dimensional body.
Apply Euler's equations of motion for rigid bodies with and without external torques.
Analyze a symmetric top using both Euler's equations and Lagrange's equations.

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)

Lectures, demonstrations, computer simulations, regular assignments

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.	Marion & Thornton	Classical Dynamics	☒	Harcourt Brace	
2.	John R. Taylor	Classical Mechanics	☒	University Science Books	
3.	Goldstein	Classical Mechanics, 2nd edition	☒	Addison-Wesley	
4.	Baierlein, R	Newtonian Dynamics	☒	McGraw-Hill	
5.	Symon	Mechanics, 3rd edition	☒	Addison-Wesley	

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

Typical Evaluation Methods and Weighting

Final exam:	50%	Assignments:	20%	Midterm exam:	30%	Practicum:	%
Quizzes/tests:	%	Lab work:	%	Field experience:	%	Shop work:	%
Other:	%	Other:	%	Other:	%	Total:	100%

Details (if necessary):

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☐

Typical Course Content and Topics

Pseudoforces and non-inertial frames.
The 'ma' force, Coriolis force, Centrifugal force and azimuthal force.
Calculus of variations with and without constraints.
Generalized co-ordinates.
Fermat's principal and the least action principle.
Relating Lagrange's equation to Newton's 2nd law.
Using Lagrange's equations with and without constraints to solve a multitude of problems.
Hamilton's equations.
Two dimensional rotation dynamics.
Inertia tensor.
Euler's equations of motion for a rigid body.
The symmetric top.