

1. Course Information

Course: Physics 3151A, Classical Mechanics, 2020-2021 Fall Term

3 hours per week, BLENDED: BOTH ONLINE AND IN PERSON INSTRUCTION.

Prerequisite(s): (Physics 1028A/B or 1301A/B or 1401A/B or 1501A/B) and (Physics 1029A/B or 1302A/B or 1402A/B or 1502A/B), or the former Physics 1020 or 1024 or 1026; Calculus 2303A/B or 2503A/B, Applied Mathematics 2402A or 2270A/B or the former Applied Mathematics 2411 or 2413.

Antirequisite(s): Applied Mathematics 3151A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Prof. Giovanni Fanchini

Room 229, Physics and Astronomy Building (PAB)

You can reach me via e-mail at gfanchin@uwo.ca, or by phone at 519-661-2111 x86238 (I will be checking my voicemailbox periodically).

When contacting the instructor by email, students must use their Western (@uwo.ca) email addresses. Other accounts (e.g. hotmail and gmail) are often tagged as spam, and it is possible your message will not be received. Please indicate the course number ("Phys 3151A") in the subject of your message.

Office hours: Thursday 4:30-6:30 PM (on Zoom - Meeting ID 963 340 9785)

3. Course Syllabus, Schedule, Delivery Mode

This course provides students with the tools to tackle more complex problems than those covered in introductory mechanics courses. These topics will include variational principles, principle of least action, Lagrangian mechanics, Hamiltonian mechanics, central force motion, rigid bodies, non-inertial reference frames and Lagrangian formulation for coupled oscillations.

Learning outcomes: please refer to <https://owl.uwo.ca/x/eSRfIH>

Lectures: Wednesday 9:30-11:30 AM Natural Science Centre (NSC) Rm 1

A Zoom meeting (Meeting ID 963 340 9785) with commented Power Point slides will be open during the Wednesday lectures for those students who are not in London and do not wish to come to class.

Tutorials: ONLINE *To be taken weekly between* Material available on OWL
 ASYNCHRONOUS *11.30 AM Wednesday and* (see below)
 (1-hour length) *4.30 PM Thursday*

Each weekly tutorial (available on “OWL > Resources” in the form of dictated Power Point presentation) contains one (or more) numerical problem(s) on the material presented during the Wednesday lecture. Students are required to download the tutorial and go through it. Students are recommended to attempt at solving each step on their own before moving to the next slide with the solution. Feel free to pause the resource as long as you like.

After the tutorial, students can connect to virtual **Office Hours** (4:30-5:30 PM Thursday, Zoom Meeting ID 963 340 9785, see point 2 above) where they have the opportunity to obtain any clarification they may require about the course material of the week.

After the office hours, students have **2 extra hours** (i.e. until 7.30 PM Thursday) to take a weekly set of quizzes (15 min. metered duration) available on “**OWL Test & Quizzes**”, which include a set of **randomized numerical and/or multiple-choice questions**. Some of the quizzes may require calculations. All of the quizzes will be about the weekly material presented in class and at the tutorial. Weekly quizzes may be taken any time from the end of the Wednesday class (i.e. 11.30 AM) to Thursday 7.30 PM.

Classes begin: September 9
Study Week: November 2-8
Classes end: December 9

Course Topics (Indicative and Subject to change)

Week (**)		
0 (ch. 6)	Sep 09	Newtonian Mechanics of single particle and Equilibrium (ch. 2) [Lect1] [Lect2]
	Sept 10	Tutorial 0 (Test not part of course grade) – Equilibrium problems
1 (ch. 7)	Sep 16	Calculus of variations: Euler's equations (Ee's) – Ee's with constraints [Lect3][Lect4]
	Sept 17	Tutorial 1 – Calculus of variations
2 (ch. 7)	Sep 23	Generalised coordinates and Lagrangian mechanics [Lect5] [Lect6]
	Sept 24	Tutorial 2 – Lagrange's equations
3 (ch. 7)	Sep 30	Lagrangian mechanics (ctd) / Lagrangian conservation theorems [Lect7][Lect8][Lect9]
	Oct 1	Tutorial 3 – Lagrangian conservation theorems and First integrals of motion
4 (ch. 8)	Oct 7	Generalised momenta and Hamiltonian mechanics [Lect10] [Lect11]
	Oct 8	Tutorial 4 – Hamilton's canonical equations
5 (ch. 9)	Oct 14	Central force motion and Orbits in a central field [Lect12][Lect13][Lect14][Lect15]
	Oct 15	Tutorial 5 – Central forces
6 (ch. 10)	Oct 21	Centre of mass, Collisions, and Scattering [Lect16][Lect17]
	Oct 22	Tutorial 6 – Collision and/or scattering problems
7 (ch. 11)	Oct 28	Non-inertial frames and Foucault pendulum [Lect18]
	Oct 29	Tutorial 7 – Non-inertial frames
	Nov 4	<i>Study week – no classes</i>
	Nov 5	<i>Study week – no classes</i>
8 (ch. 11)	Nov 11	MIDTERM
	Nov 12	Tutorial 8 – Review of momenta and products of inertia
9 (Ch. 12)	Nov 18	Rigid body (part I) [Lect19][Lect20]
	Nov 19	Tutorial 9 – Rigid body motion
10 (Ch 12)	Nov 25	Rigid body (part II) [Lect21][Lect22]
	Nov 26	Tutorial 10 – Spinning tops
11 (various chapt.)	Dec 2	Normal modes of oscillations
	Dec 3	Tutorial 11 – Normal modes of oscillations
12 (various chapt.)	Dec 9	Buffer hours and Course review
	Dec 10	

NOTES

Number in brackets (Ch. xy) refer to Chapters of the textbook (Thornton and Marion, see above).

Numbers in braces [Lect xy] refer to material that will be made available on OWL in PPT format

4. Course Materials

Required course textbook:

S.T. Thornton and J.B. Marion, Classical Dynamics of Particles and Systems, 5th edition (Brooks/Cole) available at the Campus Bookstore. Note: you will require a hard copy of this (or other) textbook if you wish to carry them to the open-book midterm and final exam.

Other classical mechanics textbooks: optional, for additional reading and consultation

At the advanced undergraduate level:

H. Goldstein, J. Safko and C. Poole, Classical Mechanics, 3rd edition (Addison-Wesley)

L.N. Hand and J.D. Finch, Analytical Mechanics (Cambridge University Press)

At the graduate level:

V.I. Arnold, Mathematical Methods of Classical Mechanics, 2nd edition (Springer).

Students should check OWL (<http://owl.uwo.ca>) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL on a regular basis.

All course material will be posted to OWL: <http://owl.uwo.ca> (Resources section of the course page)

If students need assistance, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800, or 519-661-2111 ext. 83800.

Technical Requirements

Internet connection is required, with the ability to connect to Zoom (<https://zoom.us/>) meetings for office hours. Your connection must be reliable enough to take metered “OWL Test and Quizzes” without any interruptions. To this end, a personal computer or laptop is preferable over a mobile phone connection and a cable internet connection should be preferable over a wi-fi.

5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Midterm Exam: 35%

The midterm (1h45' duration) is scheduled **IN PERSON** during lecture time (9.30-11.30 AM, room NSC-1) on the first Wednesday after Study Week (i.e. **November 11**, see course calendar above) and will include two numerical problems not dissimilar from those presented at the tutorials. The midterm covers all of the course material presented until before the Study Week. The midterm is open book, but no

electronic devices (except a non-programmable calculator) are permitted. Mobile phones cannot be used as calculators and must be turned off.

Final Exam: 35%

The final (3h00' duration) will be **IN PERSON** at a date/time scheduled by the Office of Registrar. It will include three numerical problems not dissimilar from those presented at the tutorials. The final exam covers the entire course program (i.e. it is also including all of the subjects covered at the midterm). The final is open book, but no electronic devices (except a non-programmable calculator) are permitted. Mobile phones cannot be used as calculators and must be turned off.

Weekly OWL set of quizzes: 5% each (30% max)

5% maximum per **weekly set of quizzes**. These quizzes will be **available on "OWL Tests & Quizzes" from 11.30 AM Wednesday to 7.30 PM Thursday** (with the exception of study week and the first week of the course, in which a quiz set will be available only for practice, but will not be graded). The best 6 (of 11) weekly marks will count towards the final course grade, for a maximum of $5\% \times 6 = 30\%$. As only a limited fraction of these sets of quizzes count towards the final course grade, there will be no make-up for the weekly quizzes. If you miss 6 or more weekly sets of quizzes **for medical or other documented circumstances**, the result will be reweighted using the marks from the set of quizzes you have taken (i.e. if you have taken only 5 weekly sets of quizzes because you have valid medical and/or other excuses for the other 6, the total mark of your 5 sets of quizzes will be multiplied by $6/5$, etc.).

In exceptional cases, the Department of Physics and Astronomy may adjust the final course grade and this grading scheme in order to conform to Departmental policy.

6. Accommodation and Accessibility

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf

Academic Consideration for Student Absence

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are **not** able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (i.e. the December final exam)
- absence of a duration greater than 48 hours,

- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs, see:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Consideration_for_absences.pdf

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar:

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See Academic Calendar for details (under [Special Examinations](#)).

7. Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, the centrally administered e-mail account provided to students will be considered the individual’s official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

All of the learning sessions for this course may be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

OWL-based test and quizzes may be subject to analysis for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Tests and examinations in this course may be conducted using the remote proctoring service, such as Proctortrack. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. More information about this remote proctoring service is available in the Online Proctoring Guidelines at the following link:
<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>

Tests and examinations in this course may be conducted using Zoom. You will be required to keep your camera on for the entire session, hold up your student card for identification purposes, and share your screen with the invigilator if asked to do so at any time during the exam. The exam session will **not** be recorded.

In addition, if you are planning to take your midterm or final exams remotely by handwriting on the exam sheet, a printer and scanner on the same device where you are writing the exam, clearly visible from your camera, are required.

More information about the use of Zoom for exam invigilation is available in the Online Proctoring Guidelines at the following link:

<https://www.uwo.ca/univsec/pdf/onlineproctorguidelines.pdf>

* Please note that Zoom servers are located outside Canada. If you would prefer to use only your first name or a nickname to login to Zoom, please provide this information to the instructor in advance of the test or examination.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mental_health) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/services>.