



University of Manitoba  
Faculty of Science  
Department of Physics & Astronomy

## TABLE OF CONTENTS

COURSE DETAILS.....	2
INSTRUCTOR CONTACT INFORMATION.....	2
GENERAL COURSE INFORMATION.....	2
COURSE GOALS.....	3
INTENDED LEARNING OUTCOMES.....	3
USING COPYRIGHTED MATERIAL.....	3
RECORDING CLASS LECTURES.....	3
TEXTBOOK, READINGS, MATERIALS.....	3
COURSE TECHNOLOGY.....	3
CLASS COMMUNICATION.....	4
EXPECTATIONS: I EXPECT YOU TO.....	4
EXPECTATIONS: YOU CAN EXPECT ME TO.....	5
CLASS SCHEDULE.....	5
COURSE EVALUATION METHODS.....	6
GRADING.....	6
ASSIGNMENT STYLE.....	6
ASSIGNMENT DESCRIPTIONS.....	7
ASSIGNMENT GRADING TIMES.....	7
ASSIGNMENT EXTENSION AND LATE SUBMISSION POLICY.....	7
INFORMATION ABOUT VOLUNTARY WITHDRAWAL.....	7
POLICIES.....	7
STUDENTS ACCESSIBILITY SERVICES.....	9
SCHEDULE A.....	9

## COURSE DETAILS

---

<b>Course Title &amp; Number:</b>	Physics 3650 Classical Mechanics 2
<b>Number of Credit Hours:</b>	3
<b>Class Times &amp; Days of Week:</b>	11:30 am - 12:45 pm TR
<b>Location for Classes:</b>	ARTlab 366
<b>Pre-Requisites:</b>	Not to be held with the former 016.233. Prerequisite: PHYS 2650 (016.265) (C).

---

## Instructor Contact Information

---

<b>Instructor Name:</b>	Dr. J. Burgess
<b>Office Location:</b>	Allen Building 318
<b>Office Hours or Availability:</b>	Monday 2:15-3:15 PM or by appointment
<b>Office Phone No.</b>	204-474-6180
<b>Email:</b>	jacob.burgess (at) umanitoba (dot) ca All email communication must use university e-mail accounts in accordance with the <a href="#">Communicating with Students</a> university policy.
<b>Contact:</b>	Students may contact me via e-mail, my office phone, or dropping by my office.

## General Course Information

---

### Course Description

Physics 3650 covers intermediate to advanced level mechanics. Topics include dynamics of a rotating reference frames, dynamics of rigid bodies, calculus of variations, Lagrangian formalism, Hamiltonian dynamics, canonical equations using Poisson brackets, nonlinear oscillations and chaos, coupled oscillations, and the wave equation in continuous media.

---

## Course Goals

---

The course aims to cover the development of modern classical mechanics and to introduce methodologies of solving problems that are of fundamental importance in many areas of physics based the calculus of variations.

---

## Intended Learning Outcomes

---

Students should develop a familiarity with variational methods in the context of classical mechanics and how these methods enable elegant solutions for relatively complicated problems. The goal is to improve understanding of mechanics, but also to prepare students for the study of other areas of physics where similar techniques are applied. Course material will develop critical thinking skills through solution of problems and learning class materials.

---

## Using Copyrighted Material

---

**Example:** Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright/> or contact [um\\_copyright@umanitoba.ca](mailto:um_copyright@umanitoba.ca).

---

## Recording Class Lectures

---

Jacob Burgess and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Jacob Burgess. Course materials (both paper and digital) are for the participant's private study and research.

---

## Textbook, Readings, Materials

---

Course Website:

[http://www2.physics.umanitoba.ca/u/burgess/courses/P3650/phys3650\\_2019.html](http://www2.physics.umanitoba.ca/u/burgess/courses/P3650/phys3650_2019.html)

Required Textbook: "Classical Mechanics" by John R. Taylor [2005], : University Science Books.

---

## Course Technology

---

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Student Accessibility Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social

networking (e.g. Facebook) online and offline “gaming” during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (© [S Kondrashov](#). Used with permission)

## **Class Communication**

---

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit: [http://umanitoba.ca/admin/governance/media/Electronic\\_Communication\\_with\\_Students\\_Policy\\_-\\_2014\\_06\\_05.pdf](http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf)

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy ([http://umanitoba.ca/admin/governance/governing\\_documents/community/electronic\\_communication\\_with\\_students\\_policy.html](http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html)). You are required to obtain and use your U of M email account for all communication between yourself and the university.

## **Expectations: I Expect You To**

---

I expect you to make attendance of lectures a priority and for you to miss lectures only for exceptional circumstances. Lecture notes will be available from the course website. Study from the notes and review of prior lectures before attending a lecture is highly advised. I additionally expect you to make use of office hours ask questions about any material you found challenging, unclear, or to explore course related topics that go beyond the material presented in class.

I will be in class for 5 minutes prior to and after the class time. I will treat you with respect and would appreciate the same courtesy in return. I expect you to settle in your seat before class starts and to leave only when class is completed. See the [Respectful Work and Learning Environment Policy](#).

### **Academic Integrity:**

Policies are attached in sections at the end of this document. Note the following.

- (i) Group projects are subject to the rules of academic dishonesty;
- (ii) Group members must ensure that a group project adheres to the principles of academic integrity.
- (iii) Students should also be made aware of any specific instructions concerning study groups and individual assignments;
- (iv) The limits of collaboration on assignments should be defined as explicitly as possible; and
- (v) All work is to be completed independently unless otherwise specified.

## Expectations: You Can Expect Me To

You can expect me to deliver lectures that provide a basis from which you are able to understand the basic principles of mechanics. Advancing your knowledge of physics requires critical thinking and applying the techniques learned beyond the rote reproduction of the course material. You can therefore also expect me to prompt you to use independent thought to apply these principles to understand more complex phenomena.

## Class Schedule

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the – [ROASS-Procedure](#).

There will be approximately one homework assignment every week. Lecture topics are tentative. Material on coupled oscillators and chaos will be included if time permits.

Date		Tentative Topic	Comments
Sept. 5	R	Non-Inertial Reference Frames	
Sept. 10	T	Rigid Body Motion	
Sept. 12	R	”	
Sept. 17	T	”	<i>Sept. 17: Course Drop Deadline</i>
Sept. 19	R	”	<i>Sept. 18: Course Add Deadline</i>
Sept. 24	T	”	
Sept. 26	R	Variational Calculus	
Oct. 1	T	”	
Oct. 3	R	”	
Oct. 8	T	Lagrangian Dynamics	
Oct. 10	R	”	
Oct. 15	T	”	
Oct. 17	R	”	
Oct. 22	T	”	
Oct. 24	R	Hamiltonian Dynamics	
Oct. 29	T		
Oct. 31	R	<b>MIDTERM EXAM</b>	
Nov. 5	T	”	
Nov. 7	R	”	
Nov. 12	T	-	Fall Break
Nov. 14	R	-	Fall Break
Nov. 19	T	Non-linear Oscillations/Chaos	<i>Vol. Withdrawal Date <u>Nov. 18</u></i>
Nov. 21	R	”	
Nov. 26	T	”	
Nov. 28	R	Coupled Oscillators	
Dec. 3	T	”	
Dec. 5	R	”	
Dec. 9-20, 2019		Final Exam Date TBA	Examination Period

## Course Evaluation Methods

---

A variety of methods are used in order evaluate

Due Date:	Assessment Tool	Value of Final Grade
Oct. 30, 11:30 am, in class.	Mid-Term Test	20%
Specified on assignment.	Assignments, roughly 1 every 1 week.	30%
Set by UM administration.  Exam period: December 9 - 20	Final Exam.	50%

## Grading

---

Indicate your grading scale. A sample is given below that you can adjust to your course expectations.

Letter Grade	Percentage out of 100	Grade Point Range	Final Grade Point
A+	90-100	4.25-4.5	4.5
A	80-89	3.75-4.24	4.0
B+	75-79	3.25-3.74	3.5
B	70-74	2.75-3.24	3.0
C+	65-69	2.25-2.74	2.5
C	60-64	2.0-2.24	2.0
D	50-59	Less than 2.0	1.0
F	Less than 50		0

## Assignment Style

---

Assignments must be neatly written in ink with diagrams in pencil. The assignments should not use red or green ink. The assignment should be formatted as a solution to each posed problem with a clear indication of the problem being solved. Intermediate work should be shown and the answer should be highlighted with a box or underlining.

## Assignment Descriptions

---

**Loss of 10% per day beyond deadline date.**

The mid-term will cover the material from rigid body motion, calculus of variations, Lagrangians, and some material on Hamiltonian Dynamics.

## Assignment Grading Times

---

Assignment marks are expected to be returned on UM Learn one week following the assignment due date. A sufficient percentage of the total mark in the course, including at least 4 assignments, and the midterm test, will be provided to the students before the Voluntary Withdrawal deadline. The final grades will be submitted to Aurora by the grade submission deadline and available on the Aurora website.

## Assignment Extension and Late Submission Policy

---

Assignment due dates are strict. A penalty of 10% per day beyond the deadline date will be applied.

## Information About Voluntary Withdrawal

---

Note that Voluntary Withdrawal has a number of impacts. The student must request permission to retake the course and there are limits to the number of repeated attempts. Access for VW students to the course may be limited if the course is full. A Voluntary Withdrawal shall be recorded on the Student History and Official Transcript issued by the University.

Final grades for courses in which Students ceased attending, without an official VW, will be included on the Student History and Official Transcript issued by the University, and will be factored into the Student's Grade Point Average.

## Policies

---

### POLICY ON MISSED TESTS

No rewrites are given for the mid-term test. If you miss the mid-term test for a legitimate, documented reason, then the weight of the final exam will be increased to 70%. A **missed test for any other reason counts as zero!**

## **PLAGIARISM AND CHEATING**

(University of Manitoba Undergraduate Calendar, p. 27)

To plagiarize is to take ideas or words of another person and pass them off as one's own. In short, it is stealing something intangible rather than an object. Obviously it is not necessary to state the source of well known or easily verifiable facts, but students are expected to acknowledge the sources of ideas and expressions they use in their written work, whether quoted directly or paraphrased. This applies to diagrams, statistical tables and the like, as well as to written material, and materials or information from Internet sources. To provide adequate documentation is not only an indication of academic honesty but also a courtesy which enables the reader to consult these sources with ease. Failure to do so constitutes plagiarism. It will also be considered plagiarism and/or cheating if a student submits a term paper written in whole or in part by someone other than him/herself, or copies the answer or answers of another student in any test, examination, or take-home assignment.

Plagiarism or any other form of cheating in examinations or term tests (e.g., crib notes) is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty.

## **EXAMINATIONS: PERSONATIONS**

(University of Manitoba Undergraduate Calendar, p. 26)

A student who arranges for another individual to undertake or write any nature of examination for and on his/her behalf, as well as the individual who undertakes or writes the examination, will be subject to discipline under the university's Student Discipline Bylaw, which could lead to suspension or expulsion from the university. In addition, the Canadian Criminal Code treats the personation of a candidate at a competitive or qualifying examination held at a university as an offence punishable by summary conviction. Section 362 of the Code provides:

Personation at Examination

362. Every one who falsely, with intent to gain advantage for him/herself or some other person, personates a candidate at a competitive or qualifying examination held under the authority of law or in connection with a university, college or school or who knowingly avails him/herself of the results of such personation is guilty of an offence punishable on summary conviction. 1953-54, c.51, s.347.

Both the personator and the individual who avails him/herself of the personation could be found guilty. Summary conviction could result in a fine being levied or up to two years of imprisonment.

## **FACULTY OF SCIENCE STATEMENT ON ACADEMIC DISHONESTY**

The Faculty of Science and The University of Manitoba regard acts of academic dishonesty in quizzes, tests, examinations, laboratory reports or assignments as serious offences and may assess a variety of penalties depending on the nature of the offence.



Acts of academic dishonesty include, but are not limited to bringing unauthorized materials into a test or exam, copying from another individual, using answers provided by tutors, plagiarism, and examination personation.

Note: cell phones, pagers, PDAs, MP3 units or electronic translators are explicitly listed as unauthorized materials, and must not be present during tests or examinations.

Penalties that may apply, as provided for under the University of Manitoba's Student Discipline ByLaw, range from a grade of zero for the assignment or examination, failure in the course, to expulsion from the University. The Student Discipline ByLaw may be accessed at:

[http://umanitoba.ca/admin/governance/media/Student\\_Discipline\\_Bylaw\\_-\\_2009\\_01\\_01.pdf](http://umanitoba.ca/admin/governance/media/Student_Discipline_Bylaw_-_2009_01_01.pdf)

Suggested minimum penalties assessed by the Faculty of Science for acts of academic dishonesty are available on the Faculty of Science webpage:

[http://umanitoba.ca/faculties/science/resources/Acad\\_Dishon\\_TABLE\\_RevCSS\\_AdminC\\_Jul2012\\_WEB.pdf](http://umanitoba.ca/faculties/science/resources/Acad_Dishon_TABLE_RevCSS_AdminC_Jul2012_WEB.pdf)

All Faculty members (and their teaching assistants) have been instructed to be vigilant and report all incidents of academic dishonesty to the Head of the Department.

---

## Students Accessibility Services

---

### Student Accessibility Services

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

*Student Accessibility Services* <http://umanitoba.ca/student/saa/accessibility/>

520 University Centre

204 474 7423

[Student\\_accessibility@umanitoba.ca](mailto:Student_accessibility@umanitoba.ca)

---

## SCHEDULE A

---

A Schedule A document is posted on the course website for PHYS 3650. This is a Policy and Resource Document with information on various University and Unit policies regarding academic integrity, student discipline, and respectful learning environment, for example, and on academic and student supports that are available, including a statement regarding mental health with referral information to the Student Counselling Centre and University Health Services.