

Arts & Science 2D06: Physics – Course Outline (2021/22)

Instructor: Prof. Alan Chen, Department of Physics and Astronomy

E-mail: chenal@mcmaster.ca **Office:** MS Teams (Fall); ABB-260A (Winter)

Office Hours: Thursdays, 3:30pm – 4:20pm, MS Teams (Fall) and in-person (Winter)

Class Times: Mon., Wed., 11:30am – 12:20pm; Fri., 1:30pm – 2:20pm
synchronous on MS Teams (Fall), in-person in BSB 119 (Winter)

Note: The Oct-22 and Oct-25 lectures will be pre-recorded and made available before Oct-22 for asynchronous viewing.

Required material:

- **Textbook:** Giancoli, Physics for Scientists and Engineers with Modern Physics, 4th Edition
- **Calculator:** McMaster standard calculator (CASIO fx991) – to be used for all quizzes and exams – available in the campus bookstore.

Tutorials, run weekly by the teaching assistants, will provide opportunities to practice problem-solving in a smaller group environment. Platform (Fall): MS Teams; in-person (Winter)

Teaching Assistants: Joshua Hainge (haingej@mcmaster.ca)
Denise Kamp (kampd@mcmaster.ca)
Kate Hartman (hartm2@mcmaster.ca)
Taavishi Jindel (jindelt@mcmaster.ca)

Tutorial Times: T01 Tu 11:30-12:20 – Virtual (Fall), JHE/329 (Winter)
T02 Tu 12:30-13:20 – Virtual (Fall), JHE/329 (Winter)
T03 Tu 13:30-14:20 – Virtual (Fall), JHE/329 (Winter)

Course webpage: <http://avenue.mcmaster.ca>

Marking scheme:

30% April exam

20% December exam

20% In-class quizzes (best 4 of 5 scheduled quizzes; 5% each for total of 20%)

20% Laboratory project (to be done in Winter term; details to be provided at start of Winter term)

Laboratory project report deadline: March 23, 2022

10% Participation

The December and April exams and the laboratory project must be completed to pass the course.

The final percentage grade will be converted by the standard McMaster conversion scale:

| | | |
|----------------|---------------|---------------|
| 12 = 90 – 100% | 11 = 85 – 89% | 10 = 80 – 84% |
| 9 = 77 – 79% | 8 = 73 – 76% | 7 = 70 – 72% |
| 6 = 67 – 69% | 5 = 63 – 66% | 4 = 60 – 62% |
| 3 = 57 – 59% | 2 = 53 – 56% | 1 = 50 – 52% |

0 = 49% or less

Students should keep a copy of anything handed in for marking (such as the project report). The due date for your written report in Term II is **Wednesday, March 23**, before 5 PM. If you hand in your write-up on March 22 or before, you will get a 1-mark bonus (out of a total mark of 20). Reports handed in after March 24 will have a per-day 2-mark penalty applied.

Missed Quizzes

There will be no re-weighting of marks to accommodate missed work. Students who submit MSAFs for quizzes will be required to write a make-up quiz, which will be different from the missed one but of comparable level of difficulty and same coverage of material.

Outline of Curriculum and Objectives

Course Objectives:

- To identify and discuss the underlying ideas, principles, and natural laws that describe a wide range of phenomena in the outside physical world: motion, forces, gravity, waves, fluids, light, space and time, quantum mechanics.
- To probe how scientific thinking and the progress of science is built on the twin principles of measurement and modeling.
- To study the historical development of the 'great ideas' in physics as developed by Archimedes, Galileo, Newton, Einstein, Bohr, de Broglie, Schrödinger, Heisenberg, and others; and to see how these ideas have influenced history and culture.

Outline for Term I:

- Newtonian Mechanics: Motion (kinematics) in one and two dimensions. Forces and Newton's three laws of mechanics. Friction, circular motion. Work, kinetic energy, potential energy, conservation of energy. Momentum and collisions. Rotational motion.
- Special Relativity: The speed of light, time dilation, length contraction, simultaneity, the Lorentz transformation. Momentum and energy in special relativity.

Outline for Term II:

- Fluid mechanics, hydrostatics, Archimedes' principle, Bernoulli's principle.
- Simple harmonic motion, wave motion, interference and diffraction of light.
- Quantum mechanics: early atomic theory, waves and probability, the uncertainty principle, the Schrödinger equation.
- General Relativity: the equivalence principle, curved space, black holes. Cosmology.

Arts & Science 2D06 – 2021/22 – Estimated Weekly Schedule – Term 1

| Week | Beginning | Topic |
|------|-----------|---|
| 1 | Sep 6 | One dimensional kinematics |
| 2 | Sep 13 | One and Two dimensional kinematics |
| 3 | Sep 20 | Forces, Newton's Laws |
| 4 | Sep 27 | Newton's laws of motion |
| 5 | Oct 4 | Work, kinetic energy <i>[Quiz #1 – Wed – Oct 6]</i> |
| 6 | Oct 11 | MID-TERM RECESS |
| 7 | Oct 18 | Potential energy, energy conservation |
| 8 | Oct 25 | Momentum |
| 9 | Nov 1 | Momentum conservation |
| 10 | Nov 8 | Momentum conservation |
| 11 | Nov 15 | Special relativity <i>[Quiz #2 – Wed – Nov 17]</i> |
| 12 | Nov 22 | Special relativity |
| 13 | Nov 19 | Special relativity |
| 14 | Dec 6 | Review, make-up (if needed) |

Arts & Science 2D06 – 2021/22 – Estimated Weekly Schedule – Term 2

| Week | Beginning | Topic |
|------|-----------|---|
| 1 | Jan 10 | Fluid mechanics: hydrostatics |
| 2 | Jan 17 | Fluid mechanics: fluids in motion |
| 3 | Jan 24 | Simple harmonic motion |
| 4 | Jan 31 | Wave motion and wave phenomena <i>[Quiz #4 – Wed – Feb 2]</i> |
| 5 | Feb 7 | Interference phenomena in light |
| 6 | Feb 14 | Interference of light |
| 7 | Feb 21 | MID-TERM RECESS |
| 8 | Feb 28 | Historical quantum mechanics <i>[Quiz #5 – Wed – Mar 2]</i> |
| 9 | Mar 7 | Quantum mechanics and the atom |
| 10 | Mar 14 | Uncertainty principle and other quantum ideas |
| 11 | Mar 21 | Finish quantum mechanics |
| 12 | Mar 28 | General relativity <i>[Quiz #6 – Wed – Mar 30]</i> |
| 13 | Apr 4 | General relativity |
| 14 | Apr 11 | Cosmology, review, make-up (if needed) |

SENATE-APPROVED ADVISORY STATEMENTS

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the

[Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., online search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ONLINE ELEMENT

Some courses may use online elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses online elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or

behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

In the event of an absence for medical or other reasons, students should review and follow the [Policy on Requests for Relief for Missed Academic Term Work](#).

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors. The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done either by the instructor for the purpose of authorized distribution or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

NOTES FOR ALL ARTS & SCIENCE COURSES

1. Some of the statements above refer to a "Faculty Office"; please note that the Arts & Science Program Office serves in this capacity.
2. It is the responsibility of students to check their McMaster email regularly. Announcements will be made in class, via A2L, and/or via the course email distribution list.

3. For additional information regarding requests for accommodation, relief for missed term work (e.g. MSAF), deferred examinations, etc., students should read carefully the [Requests](#) and [Resources](#) pages on the Arts & Science Program website.