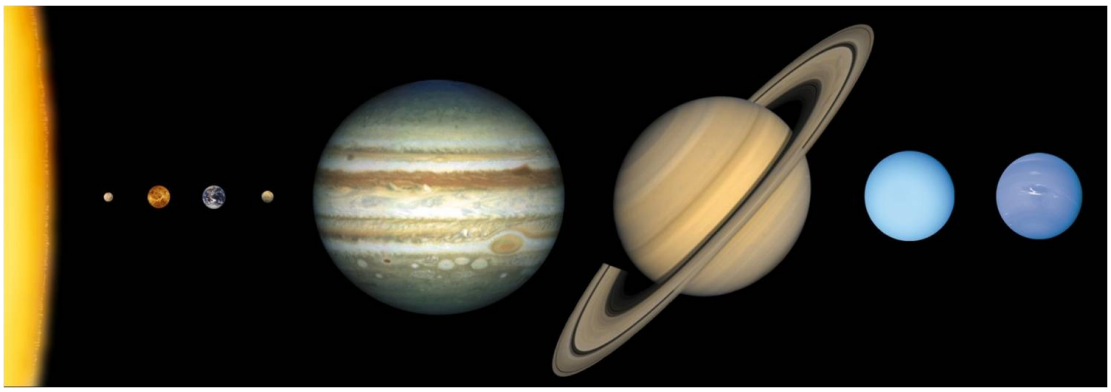
EASC 2150 – The Solar System and Planetary Science
Fall Semester, 2023: Course Outline



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Office hours: Not determined or predictable in Fall 2023. Please send an email to set up discussion. *Please do not use this email unless unable to reach me in Brightspace.

Classes and Course Notes: This course will be offered in a ***hybrid mode*** that accommodates both in-person and online learning. Weekly in-person classes will include overviews of course modules, discussions of new planetary science findings, and question/answer sessions. These class materials will also be available to online participants. More detailed classes, available online, will provide specific information on the topics within each module. The online class materials consist of compressed PDF files containing lectures, with linked audio podcast 'broadcasts' (MP3 format) from ***Radio Solar System*** providing explanation and discussion. Course materials can be downloaded ahead of time, allowing students to work offline if they wish.
In-Person classes are scheduled for Wednesdays (7.00 – 9.00 pm, St. John's time), with online quiz availability (when applicable) from 8.30 pm on the same day. The timing for online Discussion/Q&A sessions will be determined following consultation with students. Note that students with timing conflicts due to other courses, work hours or their geographic locations can be assigned alternative quiz timings or online discussion sessions by arrangement.

Textbook and Learning Resources: "*The Solar System*", by Michael Seeds and Dana Bachman (10th edition) is suggested as a resource for learning. Single-term access to the text and related resources is available directly from the publisher or via the MUN Bookstore at a reasonable price. If anyone is interested in the printed text, it can be purchased directly from Cengage or other online sellers. Earlier editions of this text are available as used items and remain useful. There are many other books on astronomy and the Solar System that are useful, and excellent course material exists on websites maintained by NASA, ESA, NOAA and other organizations. Some background Earth Science material is provided as an optional course item. Selected short articles of relevance to aspects of the course will also be posted and discussion of these is encouraged. Weekly sessions will include *Planetary Science News Items*, and students are encouraged to make suggestions for topics in these discussions.

Course Grading: The grading in the course is based on online quizzes, some simple learning assignments to keep you on track with material and ideas and a final exam that includes an online quiz component and a take-home component that asks for thoughtful short summaries of selected topics.

1. **Online Quizzes – total marks weighting 48%**

Multiple-choice/true-false/fill-in-blanks quizzes will cover material discussed in specific course modules. There are 8 quizzes scheduled, and the average of the best six marks contributes nearly half of final course marks. You can miss two quizzes without losing any marks, *but this is not recommended* – you should do them all!

Quizzes have a time assignment of 40 minutes (unless you have accommodations)

2. **Learning Assignments – total marks weighting 24%**

"Learning Crosswords" are provided at regular intervals; finding the answers to clues will keep you on track and encourage learning. There are 8 of these, for which your answers are entered online. The average of the best six marks will contribute nearly a quarter of final course marks. You can miss two without losing any marks, *but this is not recommended*. You should do them all, as they are connected to course materials!

NOTE: If you miss more than two quizzes or learning assignments, you run the risk of retaining zero entries in your final marks calculation. Thus, you are strongly advised not to take such risks. It is your responsibility to make contact quickly if there is a valid reason for absence from a quiz, or to request rescheduling in advance to accommodate conflicts. Rescheduling is subject to some time limits.

3. **Final Exam – total marks weighting 28%**

This will include an extended online quiz with questions related to the overall course content and a take-home component that will require thoughtful short summaries of selected topics. This will provide an opportunity for you to demonstrate your learning achievements and communication abilities.

Details and examples of Quizzes, Learning Assignments and the Final Exam will be provided during the course to assist you in preparations.

4. **Non-credit Learning Exercises**

In 2023, the course may include a small selection of non-credit learning exercises. These are intended to demonstrate practical applications of course concepts and strengthen your understanding. They mostly involve simple Microsoft Excel spreadsheets, so you can gain valuable experience with this now-universal program. These items will not be graded, but information will be posted, and discussion is encouraged. It is in your interest to look at this material and learn from it.

5. **Assessment Adjustments for Exceptional Circumstances**

Students who experience exceptional circumstances such as extended illness or bereavement will be offered alternative dates for evaluations, modified and/or replacement assessments, or other measures to ensure completion of the course. The exact details of such arrangements will naturally depend on the circumstances and their timing. Contact the instructor if this should happen to you.

General Course Description

This course contains two sequential parts. In each, review of established knowledge is emphasized, but attention is also paid to new findings and speculative ideas in a discipline that truly sits at the outermost frontier of the Natural Sciences. With the possible exception of some Astronomy courses offered by the Physics Department, no course at MUN offers such a long and varied journey through space and time.

Part 1: (Modules 1 to 6) begins with an introduction to the principles of Planetary Science, and a discussion of ideas about the Solar System and their development over time. This takes us from the ancient Greeks to Nikolas Copernicus, Galileo Galilei, Johannes Kepler, Isaac Newton, and eventually to Albert Einstein and Stephen Hawking. The wider context of the Solar System in the Universe is considered, as are the many new and interesting findings concerning planetary systems around other stars. Part 1 explains diverse methods used by planetary scientists to gather information and draw conclusions. It discusses kinetic and electromagnetic energy in the Solar System and beyond, and evaluates models for the formation and evolution of our solar system, which may apply to other systems around other stars.

Part 2: (Modules 7 to 13) examines individual planets, moons and other objects in our Solar System in more detail, emphasizing their diversity but also the common themes that link different planetary groups. It begins with an examination of asteroids, comets and meteorites, which are leftover construction materials from the earliest times. Our own planet, the Earth, is then discussed, because it is our reference point for all others. It is clearly unique but illustrates important controls on planetary evolution. From Earth, we blast off to the Moon and then to Mercury (small terrestrial planets with very hostile surface environments) and then loop outward to Venus and Mars. These worlds have more parallels with the Earth, but have evolved in radically different ways. Our long voyage then continues into the alien and sometimes bizarre realm of the outer planets (Jupiter, Saturn, Neptune and Uranus), and their astounding moons. Our journey ends in the little-known, empty and lonely void beyond the planetary orbits. From here, we return home to discuss the evolution and impacts of life on Earth and to speculate about potential environments for life elsewhere in the Solar System and also beyond it.

There are no prerequisites for the course, although general knowledge of Earth Science concepts (minerals, rocks, plate tectonics, etc.) is definitely useful. These topics will be summarized in an optional course module. A knowledge of basic high-school-level science concepts (e.g., exponential notation, atoms, ions, molecules, isotopes, electromagnetic radiation, etc., etc.) is assumed for *all* students, but some basic revision and explanatory material is provided in course materials.

EASC 2150 – Fall 2023 - Course Schedule

Listing of Modules and Suggested Study Periods

Modules 1,2: Orientation, Introduction, Science Concepts	Sept 6 – Sept 13
Module 3: Early Ideas and Our Place in the Galaxy & Universe	Sept 13 – Sept 20
Module 4: Astronomical Thinking and Solar System Motions	Sept 20 – Sept 27
Module 5: Energy in the Solar System and its Heart (the Sun)	Sept 27 – Oct 4
Module 6: Formation and Early Evolution of the Solar System	Oct 4 – Oct 11
General Study Break and Guest Lecture on "Giant Impacts"	Oct 11 – Oct 17
Module 7: Comets, Asteroids and other Cosmic Debris	Oct 17 – Oct 25
Module 8: Earth – Our Home and the Living Planet	Oct 25 – Nov 1
Module 9: The Moon and Mercury – Barren, Battered Worlds	Nov 1 – Nov 8
Module 10: Venus and Mars – Two worlds of Extremes	Nov 8 – Nov 15
Module 11: Jupiter and Saturn – The Giants of the System	Nov 15 – Nov 22
Module 12: Uranus, Neptune and Beyond – The Outer Limits	Nov 22 – Nov 29
Module 13: Life in the Solar System and Possibly Beyond	Nov 29 onwards

Dates and Availability Times for Online Quizzes

Wed Sept 20	8.30 to 11.59 pm – Quiz related mostly to Modules 2 and 3
Wed Sept 27	8.30 to 11.59 pm – Quiz related mostly to Module 4
Wed Oct 4	8.30 to 11.59 pm – Quiz related mostly to Module 5
Wed Oct 18	8.30 to 11.59 pm – Quiz related mostly to Module 6
Wed Oct 25	8.30 to 11.59 pm – Quiz related mostly to Module 7
Wed Nov 1	8.30 to 11.59 pm – Quiz related mostly to Module 8
Wed Nov 8	8.30 to 11.59 pm – Quiz related mostly to Module 9
Wed Nov 15	8.30 to 11.59 pm – Quiz related mostly to Module 10

(** Note that Modules 11, 12 and 13 are not assessed in the short quizzes, but will be included as part of the final online exam. Students with time-zone conflicts or other timing conflict issues will be accommodated by adjusting availability but must provide details and reasons. Note also that there will be a class during the week beginning October 2, but details of this are not yet finalized)*

Learning Exercises including Crossword Puzzles

These will be made available *before* the study periods indicated above for each Module and must generally be submitted shortly before the scheduled quiz for that Module. The timetable for these may be subject to some adjustments as not all such exercises are fully prepared in advance.

Final Online Exam

The Date and Time Slot are determined by MUN in the exam period; date for submission of take-home material will also be determined by exam scheduling.

(Non-credit examples of typical unit quizzes and learning exercises will be made available at the start of the course. The answers to all quizzes and exercises will be made available to students through Brightspace routines or posted, as applicable. They can also be discussed in weekly in-person classes or online discussion sessions)

Memorial University advises all students of the following policies and regulations. They are all important, so please take note of them.

(1) Accommodation of Students with Disabilities: Memorial University of Newfoundland is committed to ensuring an environment of understanding and respect for the dignity and worth of each student and also to supporting inclusive education based on the principles of equity, accessibility and collaboration. (http://www.mun.ca/policy/site/policy.php?id=239)

(2) Academic Integrity: Within the University community there is a collective responsibility to maintain a high level of scholarly integrity. A student is expected to adhere to those principles which constitute proper academic conduct. Academic misconduct cannot be condoned or even appear to be condoned. A student has the responsibility to know which actions, as described under **Academic Offences**, could be construed as dishonest or improper. A student is reminded that for further guidance on proper scholarly behaviour he/she should seek advice from his/her instructors and faculty advisors. (http://www.mun.ca/regoff/calendar/sectionNo=REGS-0748)

(3) Academic Support Programs

The Counselling Centre helps students develop their study strategies through academic support programming. The Centre offers support for study problems in which students learn to apply strategies for managing university level academic work more effectively. Following an intake session, students may be provided with access to an online D2L course called, "Academic Skills Portfolio," that facilitates the acquisition and practice of helpful skills.

(4) Medical Notes

When is a medical note, or other appropriate supporting documentation, required?

(1) A medical note is required when a student is absent from a final laboratory or final lecture examination due to illness and they would like to request a deferred examination or other sort of accommodation. A medical note is also required when a student misses a mid-term test/exam or other form of course work during the regular semester due to illness lasting five or more calendar days duration, that is not related to COVID-19 or influenza (see below if the cause is COVID-19 or influenza). In both cases, a request for accommodation must be made in writing no later than 48 hours after the original date of the evaluation.

(2) A medical note is required when a student is absent from a final laboratory or final lecture examination, and they would like to request a deferred examination or other sort of accommodation.

(3) A medical note is required if a student wants to drop a course following the last day to drop courses without academic prejudice, and before the last date to add courses in the following semester, and they did not complete the final exam in that course.

When is a medical note NOT required? A medical note is NOT required when a student misses a mid-term test/exam or other form of course work during the regular semester due to illness of less than five calendar days duration. If the illness lasts five days or more and is due to COVID-19 or influenza-type illness, the time limits outlined above do not apply. If the student wishes to request accommodation for illness in this case, then they must inform their instructor of their illness in writing within 48 hours of the date of test/mid-term/seminar or due date of paper/report.

For information, see: https://www.mun.ca/regoff/calendar/sectionNo=REGS-0859

(5) 6.15.6 Information Required in Certificates from Health Professionals

1. A student who requests permission to drop courses; to withdraw from University studies; to have examinations deferred or to obtain other waivers of University, departmental or course regulations based on health issues is required by the University to provide, in support of the request, a certificate from a health professional in the form of a note or letter. Such certificates must be sufficiently specific to allow a proper consideration of a student's case. The University requires that all such certificates must be on letterhead, must be signed by the health professional, must confirm the specific dates on which the student visited the health professional and should include details on the following:

- the degree to which the health issue (or treatment, in the case of medication, for example) is likely to have affected the student's ability to study, attend classes, or sit examinations;
- the length of time over which the student's abilities were likely hampered by the condition (e.g., recurring and severe back pain over a two-month period would likely have a more adverse effect on studies than a single episode of back pain requiring bed rest for a week);
- the fitness of the student to resume studies (it is in the student's best interest not to return to studies prematurely).

The University respects the privacy of students and will keep confidential all such certificates. A student should request that the health professional retain a copy of such a certificate in case the certificate needs to be verified or reissued at a later date.