



## COURSE OUTLINE

1. **Course:** ASPH 305, Introduction to Astrophysics - Fall 2019

Lecture 01: MWF 11:00 - 11:50 in ENE 239

Instructor	Email	Phone	Office	Hours
Dr Rene Plume	rplume@ucalgary.ca	contact via email only	SB 517	Thurs 10-11:30am

**Course Site:**

D2L: ASPH 305 L01-(Fall 2019)-Introduction to Astrophysics

**Note:** Students must use their U of C account for all course correspondence.

2. **Requisites:**

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

**Prerequisite(s):**

One of Physics 211, 221, 227 or Engineering 202; and one of Mathematics 249, 265 or 275. Also known as: (formerly Astrophysics 213)

3. **Grading:**

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Component(s)	Weighting %
Assignments (4) (Oct 2, Oct 23, Nov 20, Dec 6)	35
Lab Assignments (lab#1 Sept 30, lab#2 during Oct-Nov)	5 + 15
Midterm Test (In class Oct 28)	10
Final Exam	35

Each of the above components will be given a letter grade using the official university grading system. The final grade will be calculated using the grade point equivalents weighted by the percentages given above and then converted to a final letter grade using the official university grade point equivalents.

This course has a registrar scheduled final exam.

4. **Missed Components Of Term Work:**

In the event that a student misses the midterm or any course work due to illness, supporting documentation, such as a medical note or a statutory declaration will be required (see [Section M.1](#); for more information regarding the use of statutory declaration/medical notes, see [FAQ](#)). Absences must be reported within 48 hrs.

The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in [Section 3.6](#). It is the student's responsibility to familiarize themselves with these regulations. See also [Section E.3](#) of the University Calendar.

## 5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

Since the lab assignments require observing the night sky these are, by necessity, done at night. Every attempt will be made to schedule these labs on specific nights to allow students to plan their schedule. However, since the labs also require good weather, this is not always possible and students must be flexible in their scheduling.

Lab#1 is scheduled for the night of Monday, Sept 23rd (7:30pm start time). Lab will be rescheduled if weather requires.

Lab#2 is scheduled for Sept 30 - Oct 4th (7:30pm start time). Student's work in groups of 3 and pick ONE of these nights. Labs will be rescheduled if weather requires.

## 6. **Course Materials:**

Recommended Textbook(s):

Karttunen, H., Kröger, P., Oja, H., Poutanen, M., Donner, K.J. *Fundamental Astronomy 6th edition*: Springer.

Textbook: "**Fundamental Astronomy**" by H. Karttunen et al. 6th ed

## 7. **Examination Policy:**

All exams will be closed book exams. Formulae sheets will be provided as part of the exam material. Any kind of calculator is allowed (even programmable ones). However, calculator apps on cell phones are not allowed (since all cell phones should be turned off and put away).

Students should also read the Calendar, [Section G](#), on Examinations.

## 8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course

## 9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also [Section E.2](#) of the University Calendar.

## 10. **Human Studies Statement:**

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

## 11. **Reappraisal Of Grades:**

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **10 business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall immediately submit the Reappraisal of Graded Term work form to the department in which the course is offered. The department will arrange for a re-assessment of the work if, and only if, the student has sufficient academic grounds. See sections [I.1](#) and [I.2](#) of the University Calendar

b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

## 12. **Other Important Information For Students:**

a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus

Mental Health Strategy website ([Mental Health](#)).

- b. **SU Wellness Center:** The Students Union Wellness Centre provides health and wellness support for students including information and counselling on physical health, mental health and nutrition. For more information, see [www.ucalgary.ca/wellnesscentre](http://www.ucalgary.ca/wellnesscentre) or call [403-210-9355](tel:403-210-9355).
- c. **Sexual Violence:** The University of Calgary is committed to fostering a safe, productive learning environment. The Sexual Violence Policy (<https://www.ucalgary.ca/policies/files/policies/sexual-violence-policy.pdf>) is a fundamental element in creating and sustaining a safer campus environment for all community members. We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need. The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email ([svsa@ucalgary.ca](mailto:svsa@ucalgary.ca)) or phone at [403-220-2208](tel:403-220-2208).
- d. **Misconduct:** Academic misconduct (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under [Section K](#). Student Misconduct to inform yourself of definitions, processes and penalties. Examples of academic misconduct may include: submitting or presenting work as if it were the student's own work when it is not; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; collaborating in whole or in part without prior agreement of the instructor; borrowing experimental values from others without the instructor's approval; falsification/ fabrication of experimental values in a report. **These are only examples.**
- e. **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on [assembly points](#).
- f. **Academic Accommodation Policy:** Students needing an accommodation because of a disability or medical condition should contact Student Accessibility Services in accordance with the procedure for accommodations for students with disabilities available at [procedure-for-accommodations-for-students-with-disabilities.pdf](#).

Students needing an accommodation in relation to their coursework or to fulfill requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Associate Head of the Department of Physics & Astronomy, Dr. David Feder by email [phas.ahugrd@ucalgary.ca](mailto:phas.ahugrd@ucalgary.ca) or phone 403-220-8127. Religious accommodation requests relating to class, test or exam scheduling or absences must be submitted no later than **14 days** prior to the date in question. See [Section E.4](#) of the University Calendar.

- g. **Safewalk:** Campus Security will escort individuals day or night (See the [Campus Safewalk](#) website). Call [403-220-5333](tel:403-220-5333) for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.
- h. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- i. **Student Union Information:** [VP Academic](#), Phone: [403-220-3911](tel:403-220-3911) Email: [suvpaca@ucalgary.ca](mailto:suvpaca@ucalgary.ca). SU Faculty Rep., Phone: [403-220-3913](tel:403-220-3913) Email: [sciencerep@su.ucalgary.ca](mailto:sciencerep@su.ucalgary.ca). [Student Ombudsman](#), Email: [ombuds@ucalgary.ca](mailto:ombuds@ucalgary.ca).
- j. **Internet and Electronic Device Information:** Unless instructed otherwise, cell phones should be turned off during class. All communication with other individuals via laptop, tablet, smart phone or other device is prohibited during class unless specifically permitted by the instructor. Students that violate this policy may be asked to leave the classroom. Repeated violations may result in a charge of misconduct.
- k. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.
- l. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes,

assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.

## **COURSE SYLLABUS**

- Part 1 - Introduction & Coordinate Systems

Students are expected to work with different celestial coordinate and time keeping systems.

- Part 2 -Telescopes & Detectors

Students are expected to know different types of telescopes used throughout the electromagnetic spectrum, and apply concepts of angular resolution, the effect of the atmosphere and optical aberrations, limiting magnitude, and detector technology.

- Part 3 - Parallax & Proper Motion

Students are expected to convert between angular size and actual size using distance, and relate spatial motion to proper motion and radial velocity.

- Part 4 -The EM Spectrum & Photometric Concepts

Students are expected to apply basic concepts of electromagnetic radiation as a wave phenomenon and as the primary tool of observational astrophysics. Key aspects are concepts of flux and luminosity, the Planck spectrum, Doppler shift, apparent and absolute magnitudes, colour indices, bolometric magnitude, and absolute and differential interstellar extinction. Students are expected to apply these concepts in relation to radiative transfer of electromagnetic waves through matter.

- Part 5 - Radiation Mechanisms

Students are expected to understand spectral line and continuum radiation. Specific applications include the Planck spectrum in relation to physical properties of stars, energy levels of the hydrogen atom, physics of spectral line formation, absorption lines and emission lines, measurement techniques for spectra, and Kirchhoff's laws.

- Part 6 -The Sun & Stars

Students are expected to understand basic physical processes of the Sun and other stars. These include structure, hydrostatic equilibrium, convection, stellar atmospheres, nuclear fusion as a source of energy, stellar activity, spectral classification of stars, luminosity classes and surface gravity, theoretical and observational Hertzsprung-Russell diagram, the main sequence and evolves stars, and the stellar initial mass function.

- Part 7 - Celestial Mechanics

Students are expected to understand concepts of orbital motion, and apply Newtons' laws of mechanics and gravity to astrophysical situations. Key aspects are orbital motion and Kepler's laws, relate orbital velocity to mass of a central object, relate orbital velocity to escape velocity, orbital motion of objects with similar mass, spectroscopic binaries, and single-line spectroscopic binaries with application to extra-solar planets. Specific to stars and star formation, students should be able to understand and apply the virial theorem and Jeans mass of a gravitationally bound system of particles.

- Part 8 - Star Formation & Stellar Evolution

Students are expected to understand the physical relation between the interstellar medium and stars, and the origin of chemical elements in the cosmos. These subjects include the formation of stars from interstellar clouds, formation of proto-planetary disks, nuclear fusion in stars, evolution of solar mass stars and of massive stars, and synthesis of the heaviest nuclei through the s-process and the r-process.

### **Course Outcomes:**

- Students will apply quantitative measures of intensity and flux density to astrophysical objects in relation to black body radiation and transitions between discrete energy levels in atoms.
- Students will analyze the radiative transfer in a uniform layer of gas as a function of opacity in the context of spectral lines and interstellar extinction.
- Students will apply the principles of orbital mechanics related to Kepler's laws for the 2-body system of arbitrary masses, and the Virial theorem.

- Students will describe the topology and kinematics of the universe in terms of a projection on the celestial sphere, and apply methodologies to inverse this projection.

Department Approval:

Electronically Approved

Date: 2019-08-27 10:49