

# AST199F L0101 – Astronomy at the Frontier Course Outline, Fall 2019

version: Sep. 9, 2019

Instructor: Professor H. Yee

## **Course Overview:**

Astronomy is a field that attempts to answer some of the most fundamental questions about the Universe that we human beings have. Two very basic, and related, ones are: what is our place in the Universe and what is the scale of the Universe. This course has the sub-title of “The Scale of the Universe: Measuring Distances Across the Cosmos.” For us to understand the Universe, it is a fundamental requirement that we are able to measure the distances to celestial objects. In this course, we will explore what we, human beings in the 21st century, understand about the large scale structure of the Universe, and examine the key scientific achievements that allow us to attain this understanding: the ability to measure/estimate distances to: the sun, planets within our solar system, stars, galaxies, other constituents of the Universe, and ultimately, even to the edge of the observable Universe.

As a seminar course, this course differs from others in a number of key ways. One is that you are expected to engage and participate rigorously in classroom discussions. Participation will constitute a significant portion of your final grade. You will also be engaged in doing your own research and learning on the various topics in the course, and are expected to be able to communicate clearly and concisely both orally and in written work about these topics.

The course will take the form of a number of individual sections, discussing the various aspects of the scale of the Universe and distance determination from within the solar system to the edge of the Universe. Reading assignments (mostly short articles from the web and sections in the two on-line reference text books) will be assigned weekly. Students are expected to lead the discussions of some of these topics either in short presentations followed with class discussions, and group activities related to the topics, led by the instructor. Through out the course, some simple mathematics and geometry will be used in learning the key concepts of the course and also in solving simplified problems that illustrate these concepts.

## **Instructor**

Professor Howard Yee

Office: Astronomy Building, Room AB226, 50 St. George St.

Contact: email: [hyee@astro.utoronto.ca](mailto:hyee@astro.utoronto.ca); office phone: (416) 978 1771

## **Teaching Assistant:**

Harrison Winch

Office: Astronomy Building, Room AB230, 50 St. George St.

Contact: email: [winch@astro.utoronto.ca](mailto:winch@astro.utoronto.ca)

## Textbooks and Reading Materials:

While some of the materials from the course are based on articles that can be found on the web, two free, on-line, open-source texts in astronomy will be used extensively as basic references, and reading assignments will also be assigned from these:

<https://openstax.org/details/books/astronomy>

by A. Fraknoi, D. (Foothill College); Morrison, S. (NASA); Wolff (NOAO)

<https://www.teachastronomy.com/textbook/>

by C. Impey (University of Arizona)

As a general reference to astronomy, another recommended text is Bennett et al., "The Cosmic Perspective," (Addison-Wesley, edition 6 or 7), which is used by the courses AST101F and AST201S. This book provides excellent information at the non-specialist level in all subject areas of astronomy and astrophysics.

Various reference readings (mostly accessible on the internet) will be provided prior to most classes. Course notes will be posted on the Quercus course site.

The Department of Astronomy and Astrophysics Librarian, Lee Robin, has created a web page of web resources for the course at:

[http://www.astro.utoronto.ca//AALibrary/pmu199\\_fall2018.html](http://www.astro.utoronto.ca//AALibrary/pmu199_fall2018.html)

## Quercus

This course will make **significant** use of Quercus, the online course management system. You can access Quercus at:

<https://q.utoronto.ca>

[You are responsible for monitoring the course Quercus page AND your @mail.utoronto.ca e-mail address for announcements, assignments, etc. on a daily basis.](#)

Throughout the course, Quercus will be the preferred means of communication between students and instructor. Class notes, both from me and your classmates' presentations will be posted on Quercus. Assignments, reading materials and instructor e-mails, and other essential course components will be available there. If you are not familiar with Quercus or having problems accessing the Quercus page for this course, please refer to the Quercus Guide at:

<https://q.utoronto.ca/courses/46670/pages/student-quercus-guide>

or come and talk to me or the TA.

## What Will be Posted on the Quercus Site for the Course:

- Announcements (under Announcements)
- weekly reading assignments (under Assignments)
- Lecture power-point slides (under Pages)
- course outline and other course materials (under Pages).

**Office Hours:** (to be determined)

There are two office hours each week which are held in my office AB226, and one with the TA (Harrison Winch) (room to be announced). The exact times will be scheduled during the first or second class and announced on the course Quercus page. Occasionally an office hour may be rescheduled to a different hour for a specific week due to schedule conflicts. In this case, an announcement will be made well ahead of time. You are also encouraged and welcome to come and talk to me at other times outside of the office hours by making an appointment with me (via email) ahead of time.

## **Evaluation:**

Below is a table summarizing the marking scheme for the course. The items are explained in more details in sections following.

<b>ITEM</b>	<b>MARK (%)</b>
1. Beginning-of-class interview	3
2. Topic Presentations	22
3. Essay	17
4. In-Class short quizzes	10
5. Group activities	18
6. Participation	12
7. Final exam	18

## **Beginning-of-class meeting:**

I will hold mandatory “beginning-of-class” meetings with individual students during the office hours of the second or third weeks of class. The purpose of the short (~6 minutes) meeting is for me to learn about your background in science and math, your interest in astronomy (and in science, in general), and your expectations for the course. I am also hoping that such a meeting will make you more inclined to come to office hours to talk about the course during the term.

## **Topics Presentations:**

Students are responsible for making two formal presentations, of durations 12 and 14 minutes, on topics related to the course. One is to be done as a group of 3, and the other in groups of 2 (with marks of 10 and 12%, respectively). The topics and dates will be given out for students to sign-up. Details will be described in the hand-out for each presentation assignment.

## **Essay**

Each student is to select one topic from a list of about half a dozen to write an essay of approximately 2000-2500 words in length. A maximum of 5 students can choose to write (individually) on a given topic. Sign-up for the topic is on a first-come-first-served basis. The topic chosen by a student should not overlap with those chosen for her/his oral presentations. Please note that the course will use turnitin.com to review textual similarities and detect possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site. More details about the essay assignment and the topic selection will be provided by the end of September/early October.

## **Class Quizzes**

Short, multiple-choice quizzes will be given 5 times over the course. These give you the opportunities to test your understanding of materials as you learn it, so that you can quickly identify concepts about which you are unsure and seek help. The quizzes are not meant to be intimidating or difficult, and the idea is that you don't need to study for it if you understand the concepts, as some of the test questions will be on the materials discussed in the same class as the test itself.

## **Group Activities**

There will be a number of group activities, with marks worth between 2 to 4 percents each. These activities primarily involve discussions or problem solving of topics in a group setting followed by presentations to, or discussion with, the whole class. Most group work will be carried out entirely within the class period, while some may be assigned for after class and discussed during the subsequent lecture.

## **Class Participation**

Our objective in every class will be to discuss the scheduled topics for the day, with everyone taking part. The effectiveness of your participation in class discussions will be graded on the following 4-point scale for each lecture:

- 0: not present
- 1: present but participates minimally
- 2: present and participates in the discussion
- 3: present and participates frequently in the discussion
- 4: present, participates often, and shows active engagement with the subject material.

To achieve full participation marks, you should ensure that you have done the required readings and some research into the areas of the topics to be discussed in class (even if you are not the person taking the lead in them) before you come to class. The required readings and the topics to be covered will be posted on the course Quercus site.

Effective participation, warranting a grade of 3 or higher, entails asking questions,

volunteering your own ideas and interpretations, and responding to comments and questions of others. Do not wait until the end of term to start participating! When another student is making a presentation, you should be thinking critically about what he or she is saying and formulating questions to ask at the conclusion of his or her presentation (or during the presentation, if you think it would help clarify ideas being presented). Part of your participation mark will depend on your interaction with other students during the discussion period after the presentation. Again, it will help to have done some preparation.

Note: to facilitate my ability to identify you for the purpose of assigning participation grades, I will ask your permission to take a digital picture of you (in a group) holding a piece of paper with your name on it.

## **Final Exam:**

There is a final exam of two-hour duration worth 18% of the final grade.

## Writing Centres

The course exists in part to give you a chance to hone your academic research and writing skills. Writing well is an essential life skill. The University of Toronto makes several resources available to help students excel at written communication. Chief among these are the Writing Centres. There is a Writing Centre at every college on campus. They provide free one-on-one and group consultation to help students improve their writing. I strongly encourage you to take advantage of their services at your earliest opportunity. The University also maintains an excellent website detailing tips and strategies you can use to improve your writing: [www.writing.utoronto.ca](http://www.writing.utoronto.ca)

In addition to the other services they provide, the writing centers offer a series of drop-in writing workshops. No registration is required and you may attend any or all of the sessions. These workshops are certain to help boost your performance in PMU 199 L0111. Find out more at: <http://writing.utoronto.ca/writing-plus/>

If you speak English as a second language and would like some help improving your written and oral communications skills, you are strongly encouraged to make use of the English Language Learning (ELL) program. Learn more about this program here:

<http://www.artsci.utoronto.ca/current/advising/ell>

## Academic Integrity

From Appendix D of the Academic Integrity Handbook:

Academic integrity is one of the cornerstones of the University of Toronto. It is critically important both to maintain our community which honours the values of honesty, trust, respect, fairness, and responsibility and to protect you, the students within this community, and the value of the degree towards which you are all working so diligently.

According to Section B of the University of Toronto's Code of Behaviour on Academic Matters (<http://www.utoronto.ca/govcncl/pap/policies/behaveac.html>) which all students are expected to read and by which they are expected to abide, it is an offense for students to:

- Use someone else's ideas or words in their own work without acknowledging explicitly that those ideas/words are not their own with a citation and quotation marks, i.e., to commit plagiarism.
- Include false, misleading, or concocted citations in their work.
- Obtain unauthorized assistance on any assignment.
- Provide unauthorized assistance to another students. This includes showing another student your own work.
- Submit their own work for credit in more than one course without the permission of the instructors.

There are other offenses covered under the Code, but these are the most common. You are instructed to respect these rules and the values which they protect.

## **Appendix: Topics to be covered**

The list below are topics that the course intends to cover. However, it is not a definitive list, as the exact areas covered will depend on interest of the class and time available.

1. The scientific method
2. The scale of the universe
3. Units and definitions
4. How do we measure distances in daily life?
5. Distances in our Solar System: size of Earth, distance to the Sun (the Astronomical Unit), distances to the planets
6. The distance to the stars
7. Size of the Milky Way
8. Standard candles and standard rulers
9. The distance to other galaxies: the distance ladder
10. Redshift and the expanding universe
11. Direct methods for determining distances to galaxies: gravitational lensing and gravitational wave
12. Distance to the edge of the observable universe