

Syllabus for ASTR116: Spring 2018

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Lecture: MWF 12:00-1:05pm
Lab: Tues. 1:40-4:40pm
Class: Lecture #4346 and Lab #4347

Goals of the Course

This course is an introductory survey of the science of astronomy. Students completing Astronomy 116 are expected to have an ordered understanding of the development of the human quest for knowledge of the heavens, of the ways in which modern astronomers know the Universe and of the important current questions and issues in astronomy. They are expected to learn basic information about the Sun, the solar system, stars, galaxies and modern cosmology, as well as to develop a basic understanding of physical principles underlying astronomical research. They should be able to identify objects in the night sky and develop the foundation for a lifetime of appreciation and enjoyment of the heavens.

Textbook and Readings. The textbook for the course is *Discovering the Essential Universe*, 6th edition, by Neil F. Comins, published by W. H. Freeman and Co., 2012. Additional readings from other sources may be assigned from time to time, and some videos that supplement the readings and lectures will be shown.

Canvas: I will post all course materials on our **ASTR116 Canvas page**.

Office Hours: My office is in room 220 of the Oxford Science building. My office hours each week are **Thurs. 1-4**. I have an open door policy: if I am in the office and the door is open, feel free to come in. We can talk about astronomy and homework assignments, your student life, or anything else you would like to chat about. You can also email me or talk with me in class to make individual appointments.

Homework: Questions, exercises, etc., will be assigned in class. Such assignments will be turned in for a grade and students are expected to follow the Honor Code.

Additional Materials. Students will need scientific calculators for laboratory and class work.

Daily reading: After each class, I will assign the reading that you should do before coming to class the next time. By doing the reading before coming to class, you will be better prepared to follow the material covered in class.

Tests and Exams

The tests in Astronomy 116 will include objective questions, some of which will be quantitative in nature. A few questions will require Algebra to solve equations used in class. Some questions may stress reasoning with principles. Three tests will be given, during class time, on the following dates:

Test # 1 - Wednesday, February 14

Test # 2 - Friday, March 9

Test # 3 - Friday, April 13

Grade Breakdown:

Three tests count 15% each, Total 45%

Labs Reports: 15%

Lab Quizzes: 5%

Homework: 10%

Class Participation: 5%

Final Exam: 20%

***Extra Credit Observation Lab: up to +1%*

The course grades will be determined, as follows: 90-100 A, A- : 80-90 B+, B, B- : 70-80 C+, C, C- : 60-70 D : Fewer than 60, F.

Grades of A-, B+, B-, C+, C-, D+ will be assigned for sums of points near the ends of the grade ranges; example, (79.5-82.5) B-, (82.5-86.5) B, and (86.5-89.5) B+.

Attendance: I find attendance and class participation to be vital for this course. I will take attendance every lecture class. You will find the homework much easier to do if you come to class and you actively participate by asking questions. You are allowed 4 absences regardless of whether you have a valid reason for them or not. Therefore, I recommend that you save those for when you really need them (e.g. you get sick) instead of skipping class. If you exceed the 4 absences, I will deduct 2% off of your final grade for every additional absence. Being late for a class, or having your cell phone ring in the middle of one, is distracting not only for you but also for me and for your classmates. Students who are late for class for more than 10 min will generally not be allowed to attend that days lecture and will be considered absent. ATTENDANCE IS MANDATORY FOR LAB SESSIONS.

Use of Computers/Cell Phones/Tablets in class: My policy is simple, during lectures, unless I specifically say otherwise,

- No Computers
- No Tablets
- No Cell Phones

are allowed to be used.

Working with the Honor Code: The Oxford College Honor Code applies to this course as follows:

- Quizzes and exams: The work presented in these assignments should be your own. No collaboration permitted. You are expected to follow the instructions given by me and abide by the Honor Code. Sharing calculators, pencils, etc., is not allowed.
- Lab report, lab project: On these assignments you can only collaborate with your lab partner.
- Homework assignments: It is fine to work together on homework assignments but students are expected to solve and understand the problems themselves.
- Study groups: You are encouraged to form study groups and study concepts together and explain to each other things that you were not clear about from class or from your reading assignments.

Religious Holidays: You need to tell me immediately if any religious holidays will interfere with the course, especially the final exam and tests.

ASTR116 Course Lecture Topics

All dates (except for the final) are approximate, although they should be accurate to within 1-2 class dates.

| WEEK | DATE | LECTURE | READINGS |
|--------------|-----------------|--|----------------------|
| #1 | Jan. 17 | Introduction | Chapter 1 |
| 2 | Jan. 22 | Celestial Sphere, Constellations, Earth's Motion | Chapter 1 |
| | | Magnitudes, Moon Phases, Eclipses, Distance Formulas | Chapter 1 |
| 3 | Jan. 29 | History of Astronomy, Newton's and Kepler's Laws | Chapter 2 |
| | | The Nature of Light & Telescopes | Chapter 3 |
| 4 | Feb. 5 | Blackbody Radiation | Chapter 3 |
| | | Atoms and Spectra | Chapter 3 |
| 5 | Feb. 14 | TEST # 1 | Chapters 1-3 |
| | | Formation of Solar System, The Earth & Moon | Chapter 4 |
| 6 | Feb. 19 | Venus and Mars | Chapter 5 |
| | | Jupiter, Saturn, Uranus and Neptune | Chapter 6 |
| 7 | Feb. 26 | Planetary Moons | Chapter 7 |
| | | Asteroids, Comets and Meteors | Chapter 7 |
| | | The Sun | Chapter 8 |
| 8 | Mar. 9 | TEST # 2 | Chapters 4-8 |
| | | Characterizing Stars | Chapter 9 |
| | March 12-16 | <i>SPRING BREAK</i> | |
| 9 | March 19 | Formation of Stars, HR Diagram | Chapter 10 |
| 10 | March 26 | The Lives of Stars, Variable Stars and Nebulae | Chapter 11 |
| 11 | April 2 | The Deaths of Stars, Relativity and Black Holes | Chapter 12 |
| 12 | April 13 | TEST # 3 | Chapters 9-12 |
| | | Milky Way Galaxy and Dark Matter | Chapter 13 |
| 13 | April 16 | Types of Galaxies / Cosmology | Chapter 13/14 |
| 14 | April 23 | The Big Bang, History of Everything | Chapter 14 |
| | | Structure and Fate of the Universe | Chapter 14 |
| FINAL | May 3 | Final Exam 2-5pm | Chapters 1-14 |

Laboratory

The weekly Labs will consist of both in class activities as well as some nighttime observations with telescopes and cameras. Laboratory activities are designed to give the student opportunities for investigating nature with scientific methodology. All laboratory sessions will begin promptly at 1:40 p.m. in room 217 in the new science building. Students are expected to arrive on time for lab.

Laboratory work will consist of investigatory projects using the Skygazer, CLEA or NAAP software programs. Attendance at laboratory sessions is mandatory. An absence from lab will result in a 10% reduction in the student's final lab grade. The lab manual needed for a particular laboratory session will be given out in class the week before the laboratory session.

Each student's work must be their own. Collaboration is permitted only in using laboratory apparatus, and observing the sky. During the in-class labs, you may discuss your calculations or procedure, but each student must do his/her own measurements and obtain his/her own results.

Laboratory Reports. Students will submit laboratory reports in connection with the computer projects mentioned above. All reports will require written work and will be judged on the quality of writing as well as on the presentation of the results of laboratory investigations. Standards for reports will be issued and discussed in laboratory. **Lab reports are due 1 week after performing the labs in class.** Failure to turn in assignments on the designated day will result in a reduction of 10% for each day the assignment is late.

Lab Quizzes. At the start of each lab period, you will taken a short quiz comprised of questions relating to the the lab you are about to do, the lab you did the previous week, and/or recent lecture material.

Oral Presentation. Students will prepare and give short, illustrated, oral presentations concerning a current topic in Astronomy. Details will be issued after midterm. The oral presentations will take place during the last laboratory sessions on April 17 and 24.

In Class Labs

1. The Night Sky. (Skygazer4.5 software)
2. Equatorial System and Planetary Motion. (Skygazer4.5)
3. Jupiter's Mass. (CLEA)
4. Moon Lab and the Inverse Square Law of Light. (Handouts)
5. Extrasolar Planets. (NAAP)
6. Hertzsprung-Russel (HR) Diagram. (Skygazer4.5)
7. Atmospheric Retention (NAAP)
8. Variable Stars. (Handouts)
9. The Color Index of Stars. (CLEA)
10. Hubble's Law. (CLEA)

- **CLEA Computer Labs** All of the programs used to run the labs can be downloaded for FREE from the website at <http://www3.gettysburg.edu/~marschal/clea/CLEAhome.html> Note: these labs contain .exe files and will NOT work on Mac computers.
- **NAAP Computer Labs** All of the programs used to run the labs can be downloaded for FREE from the website at <http://astro.unl.edu/naap/>

Outdoor Telescope Observation and Photography Labs:

We will be going outside three times during the semester to observe the Sun, the Moon, and stellar constellations. The exact dates will depend of course upon the weather, but we will not go out on either Friday or Saturday nights. In some cases the outdoor observational labs will be in addition to the regular weekly in class labs, in some cases they will replace them. The observational labs will include taking photos and/or videos using telescopes and digital cameras. Following the observational labs, you will do some exercises and image processing work on the computer back in the lab.

1. *Constellations, Star Trails and Star Colors* – We will observe and photograph several constellations from the Oxford college soccer field on a night with very clear skies.
2. *The Moon* – We will observe and photograph the Moon at very high resolution. The telescopes and cameras will be set up right in front of the science building. The best times are a few days *before* the full Moon so that it is very high in the sky in the early evening.
 - Full Moon Dates: Jan. 31, March 1 and March 31, 2018.
3. *The Sun* – Will be done sometime mid semester during the regular Tuesday afternoon lab time.

** Possible Extra Credit Observation Lab **

This will occur late in the semester and will involve a night time telescope and/or camera celestial observation. A completed lab will earn a maximum of 1 point towards your final course grade.

Astronomy Computer Software Programs:

On my webpage at <http://www.philsegre.com/astronomy-software>, I give links to many useful astronomy program that are free to download and use. Use this webpage to find and download the following required programs...

1. **Skygazer4.5 DEMO:** The free sky planetarium software Skygazer4.5 DEMO, available for both Windows and Mac computers.
2. **StarStax:** The free star trails program StarStax, available for both Windows and Mac computers.

Astronomy Software Phone App:

1. **iPhone - SkySafari 6:** \$0.99 – Planetarium software to visualize the night sky.
2. **Android - SkySafari 5:** \$0.99 – Planetarium software to visualize the night sky.