American Public University System

The Ultimate Advantage is an Educated Mind

School: School of Science and Technology
Course Number: SCIN134
Course Name: Introduction to Astronomy with Laboratory
Credit Hours: 4
Length of Course: 16 weeks
Prerequisite: MATH110 (Recommended)

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Course Description (Catalog)

This course will introduce students to the wonders of the universe. Topics will include deciphering the motions of objects in the sky, learning how astronomers decode the light coming to us from distant objects, exploring the Earth and other bodies in our solar system, and investigating the properties and structure of stars, galaxies, and the universe itself. Students will be encouraged to develop conceptual understanding of these topics beyond memorization of facts. In the laboratory component, students will engage in astronomical inquiry using online tools to learn how astronomers work: by asking research questions, collecting data, and defending evidence-based conclusions. While the course is conceptual in nature, students should expect to use some mathematics. Completion of at least college algebra prior to taking this course is highly recommended.

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Course Scope

This is a survey course of astronomy that covers a wide range of material, from the patterns of motion we see in the sky from Earth to the current ideas about the evolution and large-scale structure of the entire universe. Along the way, we will acknowledge the contributions of some historical scientists, look at the tools and techniques modern astronomers use to probe the universe, examine the formation and nature of our Solar System (including the star at its center, the Sun), the properties of other stars, and the structure of our Milky Way Galaxy and the other galaxies beyond. Clearly, as an introductory survey course, the objectives of this class are geared towards gaining a conceptual understanding of these topics and how astronomy is done, rather than memorizing a lot of facts. We will be using some mathematics, though almost all math in the class will be at the level of college algebra or below (a couple exceptions to this will be addressed in the course material). The math concepts used in this class will be mainly evaluating algebraic expressions (solving for a variable), using scientific notation and reading graphs. The laboratory part of the class is designed to give students experience with the actual process of scientific inquiry. Students will also conduct peer reviews of some of the lab work, giving a taste of that very important part of science, as scientists share their work and learn from and with each other. The overall goal of the course is to give students a framework within which to understand astronomy topics in the news, to hopefully excite a lifelong interest in enjoying looking at the sky (knowing more about what is up there), and to provide a strong foundation upon which to build, if the student should decide to take more in-depth astronomy courses in the future.

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Course Objectives

After successfully completing this course, you will be able to

- Interpret the motions of the stars, Sun, and Moon in the sky and how those motions combine to create seasons, lunar phases, and eclipses. (CO-1)
- Relate how astronomers use telescopes and electronics to analyze the electromagnetic spectrum to identify properties of celestial objects. (CO-2)
- Recall major advances in astronomical knowledge contributed by such scientists as Copernicus, Galileo, Kepler, and Newton. (CO-3)
- Explain how our solar system is thought to have evolved, and how these ideas inform our search for extrasolar planets. (CO-4)
- Describe the structure of Earth's interior, surface, atmosphere, and magnetic field. (CO-5)
- Compare and contrast the surface processes and/or atmospheres of both the terrestrial and gas giant planets of our solar system. (CO-6)
- Summarize the methods used to search for life beyond Earth, and the reasons for thinking it might exist. (CO-7)

- Explain the process by which the Sun and other stars make energy and transport it from their cores outward into the system surrounding them. (CO-8)
- Make use of the Hertzsprung-Russell diagram and other methods to classify stars based on their observed properties, and distinguish the corresponding patterns in their life cycles. (CO-9)
- Relate how astronomers have deduced the shape and structure of the Milky Way Galaxy. (CO-10)
- Distinguish between different types of galaxies, and identify how observations of distant galaxies have been used to probe the large-scale structure of the universe. (CO-11)
- Outline the evidence for the evolution of the universe. (CO-12)
- Demonstrate the ability to develop a research question and then collect and analyze data to form an evidence-based conclusion. (CO-13)

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Course Delivery Method

This course delivered via distance learning will enable students to complete academic work in a flexible manner, completely online. Course materials and access to an online learning management system will be made available to each student. Online assignments are due by Sunday evening of the week as noted and include Forum questions (accomplished in groups through a threaded forum), examination, and individual assignments submitted for review by the Faculty Member). Assigned faculty will support the students throughout this sixteen-week course.

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Course Resources

Required Course Textbooks

Slater, Timothy F. and Roger Freedman. Investigating Astronomy: A Conceptual View of the Universe, First Edition. W.H. Freeman, 2012.

If you are overseas, you will receive a physical copy of the text. Stateside students will access it through the AstroPortal website (see below).

Required Readings

Additional lecture material in the form of PowerPoint files is located online in the classroom in each week's lesson.

Additional Resources

Laboratory materials are provided online in the classroom, and at the web sites listed below.

Web Sites

This course requires access to the website *AstroPortal for Investigating Astronomy* for online tutorials and homework assignments. Access instructions are provided in a PowerPoint file in the first lesson in the classroom and in the first announcement. Additionally, the laboratory assignments require access to certain web sites that are outlined in each laboratory lesson and listed below.

Lab	Web Site URL/Address
1	http://spacetelescope.org/images/heic0406a/
	http://www.aip.de/groups/galaxies/sw/udf/swudfV1.0.html
2 & 3	http://www.heavens-above.com
4	http://www.wunderground.com/history/
5	http://space.jpl.nasa.gov/
6	http://exoplanets.org
7	http://cse.ssl.berkeley.edu/Segwayed/lessons/Sunspots/activity.html
8	http://www.rc-astro.com/clusters.php http://www.astronomynotes.com/starprop/s5.htm
9	http://zoo2.galaxyzoo.org

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Evaluation Procedures

This is a 16-week course. To allow for flexibility in the schedule, the lessons will open one week in advance, to allow you to work ahead if you know that you will have a busy schedule. Make sure to pay close attention to the information in the Lessons **and** the weekly Announcements for details about which assignments are due when.

Reading Assignments: Each week corresponds to one chapter of the textbook (weeks 1 through 15). You should do this reading before any other assignment.

PowerPoint Lectures: In each lesson in the classroom, you will find a PowerPoint presentation that elaborates on the chapter for that week. There is text in the notes field of the slides, so be sure to view the presentation with the notes field visible. Review the PowerPoint after reading the chapter in the textbook.

AstroPortal Homework Assignments: After you've completed the reading, the next step is to do the assignments on the AstroPortal web site. For each chapter, there will be a set of tutorials and other exercises designed to help you develop conceptual understanding of the topics. There are questions as part of these exercises, and the system will give you a grade, but that will not be your official grade for the assignment. As long as you score at least 50% average on the assignments (and complete **all** exercises for that chapter), you will receive full credit for that chapter's homework. That way, you don't need to be stressed about it and can concentrate on learning (but you also probably can't get full credit by randomly clicking answers). Earning an average of less than 50%, but at least 25%, on the assignments will earn 2 points for that chapter's homework. An average of less than 25%, but higher than 0, will earn 1 point. If you encounter technical difficulty with the site, please let me know right away. All the AstroPortal assignments together are worth 22.5% of your course grade.

Introduction Forum Assignment: In week 1, you are required to post in the introductions forum, and the post must be at least 250 words to meet the APU/AMU-wide requirement. Details about this posting are in the description at the top of that forum. This assignment is worth 0.5% of your course grade.

Forum Assignments: In addition to the introduction forum, you will have 8 forum assignments, which will each span two weeks. You are required to post your own response to the prompt and to respond to *at least* two of your classmates. Your main post must be at least 200 words, and your responses must be substantive (not merely saying "Good post"). I encourage you to exceed the minimum in these assignments, and to engage with each other in conversation as we build a learning community in this class. Each forum assignment is worth 1% of your course grade.

Exams:

There will be three midterms and one final exam in this class. Each midterm will cover four chapters of material, and will be worth 10% of your course grade. Midterm #1 will be in week 5 and will cover chapters 1-4. Midterm #2 will be in week 9 and will cover chapters 5-8. Midterm #3 will be in week 13 and will cover chapters 9-12. The final exam, in week 16, will be cumulative, though with a slight weighting towards chapters 13-15. It will be worth 15% of your course grade. The exams are all open-book, but you may not receive help from another person during the exam. This is on the honor system, and you are expected to act accordingly. Short answer questions should be answered ***in your own words***, not copied from the text or any other source.

Laboratory Assignments:

The lab assignments in this class were developed by astronomy education experts with the intention of teaching the process used by astronomers to gather data and analyze it to reach an evidence-based conclusion. You will be using real images and data from various scientific sources on the web to analyze. The labs are in Word document format in the lessons. You will

download these to complete them, and then upload the completed document. During most weeks, there will be one lab. During midterm weeks, instead of a full lab, you will have a "mini-conference" assignment (described below). At the beginning of each lab, you are guided through the whole process of scientific inquiry (asking a research question, collecting and analyzing data, and coming to an evidence-based conclusion). In each successive phase of the lab, you take on more of the process starting at the end (with the evidence-based conclusion) and moving toward the beginning (asking a research question). By the end of the lab, having seen a few examples of the process with the data in question, you will take on the whole process. Based on data collected by astronomy education researchers who developed and have assigned these labs (both in online and brick-and-mortar settings), you may expect to take about two-and-a-half hours or so on the first labs, as you get used to the process. By around the third lab, expect the labs to take an hour-and-a-half to two hours each (just as if you were in a two-hour weekly lab in a brick-and-mortar course). Each of the nine labs is worth 2% of your course grade, though they will be graded on a scale of 0-10 points. There is a Lab Q&A forum for questions. If you are unsure of how to complete any part of a lab, you need to ask questions either in the forum or in a message to me.

Mini-Conferences:

During the three weeks when you will be taking your midterm exams (weeks 5, 9 and 13), you will not have a full lab assignment. Instead, you will participate in a mini-conference. One way that scientists share results from their work is to release their results at a scientific conference. This gives their colleagues the opportunity to look at the work and comment on it. When scientists share their work, either at conferences or submitting papers for publication, they go through a process of peer review. You will do a similar process, which is detailed in the Lesson for those weeks. Each mini-conference assignment is worth 1% of your course grade.

Symposium Project

The Symposium Project is the culmination of the lab portion of the course. Details of this assignment will be in the lessons for weeks 13, 14, and 15. By the end of week 15, you will post your project in the Symposium Project Forum. For this assignment, you will be having your own class symposium. At a symposium (sometimes also called a colloquium), scientists will present their work in the form of a short talk (often using something like PowerPoint). At scientific conferences, presentations of results of research projects are often made into posters, and there is usually a large room where these posters are put up for others to read. Presenters will sometimes stand at their posters at designated times to discuss their work with their colleagues. You will put your project together in some form that makes it easy to read. You may use PowerPoint, Word, or some other format (as long as it will be easily readable by everyone). Examples are provided in the Lesson area. Our version of the discussions that happen at symposia and conference poster presentations will be for you to read your classmates' presentations. Read as many of these projects as you wish, but you must post a peer review of

at least two. Instructions for the peer review are in the Weeks 15-16, Chapter 16 lesson. Your poster will be worth 2% of your course grade, and your two peer reviews will be worth 1%.

The table below shows the points for each assignment. You must earn at least 60% of the total scores for the lab assignments (labs, mini-conferences, and symposium) in order to pass this class. It is a 4-credit course because of the laboratory requirement, and as such you must pass the lab portion to pass the course.

Assignments	% of Course Grade
Introduction Forum	**0.5%**
Forum Assignments (8)	**8%**
Weekly AstroPortal Homework (15)	**22.5%**
Midterm Exams (3)	**30%**
Labs (9)	**18%**
Mini-Conference Peer Reviews (3)	**3%**
Symposium Project	**2%**
Symposium Project Peer Reviews	**1%**
Final Exam	**15%**
Total Course Points	**100%**

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16 – Week Course Outline

Please see the Student Handbook to reference the University's grading scale.

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Week	Topic	Course Objectives	Readings	Assignment
1	**Predicting the Motions of the Stars, Sun and Moon**	**CO-1:** Interpret the motions of the stars, Sun, and Moon in the sky and how those motions combine to create seasons, lunar phases, and eclipses.	**Text Reading:** *Slater & Freedman, Chapter 1* **Other Materials:** *PowerPoint, Chapter 1*	Introductions Forum Post Forum #1 AstroPortal Chapter 1
2	**Decoding the Hidden Messages in Starlight**	**CO-2:** Relate how astronomers use telescopes and electronics to analyze	**Text Reading:** *Slater & Freedman, Chapter 2*	Forum #1 AstroPortal

		the electromagnetic spectrum to identify properties of celestial objects.	**Other Materials:** *PowerPoint Lecture, Chapter 2*	Chapter 2 Lab #1 – Hubble
3	**Analyzing Scales and Motions of the Universe**	**CO-3:** Recall major advances in astronomical knowledge contributed by such scientists as Copernicus, Galileo, Kepler, and Newton.	**Text Reading:** *Slater & Freedman, Chapter 3* **Other Materials:** *PowerPoint, Chapter 3*	Forum #2 AstroPortal Chapter 3 Lab #2 – Sun's Motion
4	**Exploring Our Evolving Solar System**	**CO-4:** Explain how our solar system is thought to have evolved, and how these ideas inform our search for extrasolar planets.	**Text Reading:** *Slater & Freedman, Chapter 4* **Other Materials:** *PowerPoint Lecture, Chapter 4*	Forum #2 AstroPortal Chapter 4 Lab #3 – Constellations
5	**Uncovering Earth's Systems**	**CO-5:** Describe the structure of Earth's interior, surface, atmosphere, and magnetic field.	**Text Reading:** *Slater & Freedman, Chapter 5* **Other Materials:** *PowerPoint, Chapter 5*	Midterm #1 (Chapters 1-4) Forum #3 AstroPortal Chapter 5 Mini-Conference #1
6	**Exploring Terrestrial Surface Processes**	**CO-6:** Compare and contrast the surface processes and/or atmospheres of both the terrestrial and gas giant planets of our solar system.	**Text Reading:** *Slater & Freedman, Chapter 6* **Other Materials:** *PowerPoint, Chapter 6*	Forum #3 AstroPortal Chapter 6 Lab #4 – Weather
7	**Observing the Dynamic Giant Planets**	**CO-6:** Compare and contrast the surface processes and/or atmospheres of both the	**Text Reading:** *Slater & Freedman, Chapter 7* **Other Materials:**	Forum #4 AstroPortal Chapter 7

		terrestrial and gas giant planets of our solar system.	*PowerPoint, Chapter 7*	Lab #5 – Jupiter's Moons
8	**Looking for Life Beyond Earth**	**CO-7:** Summarize the methods used to search for life beyond Earth, and the reasons for thinking it might exist.	**Text Reading:** *Slater & Freedman, Chapter 8* **Other Materials:** *PowerPoint, Chapter 8*	Forum #4 AstroPortal Chapter 8 Lab #6 – Extra-solar Planets
9	**Probing the Dynamic Sun**	**CO-8:** Explain the process by which the Sun and other stars make energy and transport it from their cores outward into the system surrounding them.	**Text Reading:** *Slater & Freedman, Chapter 9* **Other Materials:** *PowerPoint, Chapter 9*	Midterm #2 (Chapters 5-8) Forum #5 AstroPortal Chapter 9 Mini-Conference #2
10	**Observing Properties of Distant Stars**	**CO-9:** Make use of the Hertzsprung-Russell diagram and other methods to classify stars based on their observed properties, and distinguish the corresponding patterns in their life cycles.	**Text Reading:** *Slater & Freedman, Chapter 10* **Other Materials:** *PowerPoint, Chapter 10*	Forum #5 AstroPortal Chapter 10 Lab #7 – Sunspots
11	**Inferring Patterns in Star Life Cycles**	**CO-9:** Make use of the Hertzsprung-Russell diagram and other methods to classify stars based on their observed properties, and distinguish the corresponding patterns in their life cycles.	**Text Reading:** *Slater & Freedman, Chapter 11* **Other Materials:** *PowerPoint, Chapter 11*	Forum #6 AstroPortal Chapter 11 Lab #8 – Star Clusters

12	**Predicting the Violent End of the Largest Stars**	**CO-9:** Make use of the Hertzsprung-Russell diagram and other methods to classify stars based on their observed properties, and distinguish the corresponding patterns in their life cycles.	**Text Reading:** *Slater & Freedman, Chapter 12* **In Course Materials:** *PowerPoint, Chapter 12*	Forum #6 AstroPortal Chapter 12 Lab #9 – Galaxy Zoo
13	**Exploring our Galaxy**	**CO-10:** Relate how astronomers have deduced the shape and structure of the Milky Way Galaxy.	**Text Reading:** *Slater & Freedman, Chapter 13* **In Course Materials:** *PowerPoint, Chapter 13*	Midterm #3 (Chapters 9-12) Forum #7 AstroPortal Chapter 13 Mini-Conference #3
14	**Investigating Other Galaxies**	**CO-11:** Distinguish between different types of galaxies, and identify how observations of distant galaxies have been used to probe the large-scale structure of the universe.	**Text Reading:** *Slater & Freedman, Chapter 14* **In Course Materials:** *PowerPoint, Chapter 14*	Forum #7 AstroPortal Chapter 14 Symposium Project
15	**Observing the Evolution of the Universe**	**CO-12:** Outline the evidence for the evolution of the universe. **CO-13:** Demonstrate the ability to develop a research question and then collect and analyze data to form an evidence-based conclusion.	**Text Reading:** *Slater & Freedman, Chapter 15* **In Course Materials:** *PowerPoint, Chapter 15*	Forum #8 AstroPortal Chapter 15 Symposium Project
16	**Review and Final Exam**	**CO-13:** Demonstrate the	**None**	Forum #8

		ability to develop a research question and then collect and analyze data to form an evidence-based conclusion.		Final Exam (cumulative) Symposium Project Peer Reviews

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Policies

Please see the Student Handbook to reference all University policies. Quick links to frequently asked question about policies are listed below.

Drop/Withdrawal Policy
Plagiarism Policy
Extension Process and Policy
Disability Accommodations

Writing Expectations

All written submissions should be submitted in a font and page set-up that is readable and neat. It is recommended that students try to adhere to a consistent format, such as that described below.

- Typewritten in double-spaced format with a readable style and font and submitted inside the electronic classroom (unless classroom access is not possible and other arrangements have been approved by the professor).
- 11 or 12-point font in a style such as Arial, Helvetica or Times New Roman.

Citation and Reference Style

Assignments completed in a narrative essay or composition format must follow a widely accepted citation style, such as APA, Turabian or MLA. Please refer to the Online Library for further examples, or contact the instructor with questions.

Late Assignments

Students are expected to submit classroom assignments by the posted due date and to complete the course according to the published class schedule. As adults, students, and working professionals, I understand you must manage competing demands on your time. Should you need additional time to complete an assignment, please contact me ***before the due date*** so we can discuss the situation and determine an acceptable resolution. Routine

submission of late assignments is unacceptable and may result in points deducted from your final course grade.

Netiquette

Online universities promote the advancement of knowledge through positive and constructive debate – both inside and outside the classroom. Forums on the Internet, however, can occasionally degenerate into needless insults and "flaming." Such activity and the loss of good manners are not acceptable in a university setting – basic academic rules of good behavior and proper "Netiquette" must persist. Remember that you are in a place for the rewards and excitement of learning which does not include descent to personal attacks or student attempts to stifle the Forum of others.

- **Technology Limitations:** While you should feel free to explore the full-range of creative composition in your formal papers, keep e-mail layouts simple. The Sakai classroom may not fully support MIME or HTML encoded messages, which means that bold face, italics, underlining, and a variety of color-coding or other visual effects will not translate in your e-mail messages.
- **Humor Note:** Despite the best of intentions, jokes and especially satire can easily get lost or taken seriously. If you feel the need for humor, you may wish to add "emoticons" to help alert your readers: ;-), :), ☺

Disclaimer Statement

Course content may vary from the outline to meet the needs of this particular group.

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Online Library

The Online Library is available to enrolled students and faculty from inside the electronic campus. This is your starting point for access to online books, subscription periodicals, and Web resources that are designed to support your classes and generally not available through search engines on the open Web. In addition, the Online Library provides access to special learning resources, which the University has contracted to assist with your studies. Questions can be directed to **librarian@apus.edu**.

- ***Charles Town Library and Inter Library Loan:*** The University maintains a special library with a limited number of supporting volumes, collection of our professors' publication, and services to search and borrow research books and articles from other libraries.
- ***Electronic Books:*** You can use the online library to uncover and download over 50,000 titles, which have been scanned and made available in electronic format.

- ***Electronic Journals:*** The University provides access to over 12,000 journals, which are available in electronic form and only through limited subscription services.
- ***Tutor.com***: AMU and APU Civilian & Coast Guard students are eligible for 10 free hours of tutoring provided by APUS. Tutor.com connects you with a professional tutor online 24/7 to provide help with assignments, studying, test prep, resume writing, and more. Tutor.com is tutoring the way it was meant to be. You get expert tutoring whenever you need help, and you work one-to-one with your tutor in your online classroom on your specific problem until it is done.

Library Guide (http://apus.campusguides.com/SCIN134)

The AMU/APU Library Guides provide access to collections of trusted sites on the Open Web and licensed resources on the Deep Web. This course guide provides links to a number of sources relevant to this course, including journals, books, and web sites. Also, you can directly contact the librarian assigned to this course for assistance in locating information.

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Turnitin.com

Faculty may require assignments be submitted to Turnitin.com. Turnitin.com will analyze a paper and report instances of potential plagiarism for the student to edit before submitting it for a grade. In some cases professors may require students to use Turnitin.com. Typically the course professor will establish a Turnitin.com access code for his/her classes. If the code has not been established, those who wish to use Turnitin.com may ask their professor to establish the code.

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