

Astronomy 151 Syllabus

Astronomy 151 – A Journey Through the Solar System

Spring 2019 Semester

University of Tennessee, Knoxville

Instructor: Dr. Sean Lindsay

E-mail: slindsay@utk.edu

Office: Room 215 in Nielsen Physics and Astronomy

Note that the Physics and Astronomy Main Office is Room 401 in Nielsen

Office Hours: Tuesday: 3:00 – 4:00 PM

Wednesday: 1:30 – 2:30 PM

CRN – Section: ASTR151 – 002 CRN: 24097

Meeting Time: Monday, Wednesday, and Friday: 12:20 – 1:10 PM

Meeting Location: Nielsen Physics and Astronomy Room 415 (PHYS 415)

Teaching Assistants: *Primary:*

Secondaries:

Course Description

This course is an introduction to the astronomical study of our Solar System. Astronomy is the study of the universe including what it is, what it contains, and what physical principles govern it. As a general astronomy course, we will study the motions of objects in the sky; the motion of the planets and stars; the historical foundations astronomy; the general physical principles of light and how it interacts with matter; and how telescopes operate over the entire wavelength range of the electromagnetic spectrum. With a focus on the astronomical study of our Solar System, we will cover the origins and evolution of the Solar System; understanding comparative planetology; the planets and small bodies in the Solar System; and the Sun. If time allows, we will expand our study to include planets in orbit around other stars (extrasolar planets) and their planetary systems. As a physical science, the study of astronomy requires mastery of fundamental scientific principles and mathematical analysis. The mathematical analysis will be emphasized, but overall, kept to the basics.

Course Textbook

Astronomy: At Play in the Cosmos 1st Edition by Adam Frank (ISBN: 978-0-393-93522-6) **with online SmartWork 5 registration**¹. Available at the UT Bookstore and from online vendors. eBook purchases acceptable. If purchased from another vendor, make sure it includes online access to Smartwork5. **NOTE: DUE TO A SMARTWORK5 GRADEBOOK ERROR, THE HOMEWORK SYSTEM IS FREE THIS SEMESTER.**

¹ ***SmartWork 5 (There is currently a grading bug with the SmartWork 5 system, so the publisher, W. W. Norton is providing access for free – homework platform only!)***. This means you can save money by renting or buying a used book.

Canvas – The Course Website

Our course website is Canvas. I will put information such as this syllabus, course announcements, supplemental materials, exam study materials, and other resources relevant to the class on Canvas. Please check the site regularly, and [enable, at a minimum, course announcements from Astronomy 151](#). [See Canvas Notification Settings: <https://utk.instructure.com/courses/55015/pages/canvas-basics-setting-your-notifications>]

DO NOT TRUST THE CANVAS GRADE COLUMN ENTITLED “TOTALS”. *Canvas has a notoriously difficult to work with gradebook, and as such, I only report scores on Canvas.* It is not possible to turn off the gradebook column “Total,” so Canvas will automatically calculate a grade there. THIS IS NOT YOUR COURSE GRADE. I will disable all assignment grades from contributing to the total, so for much of the semester, this value will be 0.00%.

Course Learning Objectives

Upon successful completion of this course, students are expected have a mastery of the following:

1. Understand the fundamental ideas of the scientific method as applied to the science of astronomy.
2. Understand how astronomers collect, analyze, and interpret information for objects beyond Earth.
3. Understand the basic motions of the Earth and Moon and their connections to how objects (the Sun, stars, and planets) move in the sky and what is locally observable.
4. Describe several Earth-based observed natural phenomena including: the cause of Earth’s seasons; the tides; eclipses; and the phases of the Moon.
5. Have an increased understanding on the nature of light, how objects with a temperature emit light, and how light interacts with matter.
6. Understand the overall structure of the Solar System, its origins, and its evolution to its current state.
7. Understand comparative planetology and the general nature of planets, including our terrestrial, gas giant, and ice giant planets.
8. Gain general knowledge on the characteristics of the eight planets of the Solar System as well as the small bodies (asteroids, comets, and Kuiper Belt Objects including Pluto). Understand that there are innumerable other planets and planetary systems in the universe, and there are more types of planets than what we observe in our Solar System

An additional, and perhaps the most important, goal of this course is my hope that through the study of astronomy, students will have increased scientific literacy, appreciation for science and astronomy, and an increased public trust in science and scientists. I strongly desire that you gain an appreciation for how science works and that the knowledge it produces is done so with the highest rigor of any human endeavor to date. As a technological society built upon our foundations of scientific knowledge, understanding the nature of science is critical to our culture, civilization, and future. As university educated people, we should all have a basic grasp of the amazingly rich human endeavor of science.

Course Units/Topics

Over the course of this semester, we cover the following THREE major course units.

- I. **General Astronomy: Chapters 1 – 4.** *In this unit, we will tackle the questions: What is the study of astronomy, and how do astronomers make sense of the universe? Here we study the tenants of science; the scale and contents of the universe; celestial motions and laws; the physics of light and its interactions with atoms; and the basics of telescopes.*
- II. **The Solar System & Earth: Chapters 5 - 6:** *In this unit, we take an inventory of what exists in our solar system and the overall structure of the solar system. We explore our modern understanding of the formation and evolution the solar system. Extending past our planetary system, we will briefly examine the nature of planetary systems outside of our own to understand the full range of types of planets and the mechanisms at work to build entire planetary systems.*
Once we have a general understanding of the solar system in bulk, we move into our study of the planets by starting with our home world, Earth. As the planet that we know the most about, we study the formation, evolution, internal structure, and processes that reshape the surface, to build a knowledge base to which the other planets are compared. In this unit, we also delve into understanding the Moon, including its origins, evolution, and influence on Earth.
- III. **The Planets: Terrestrial, Gas Giant, and Ice Giants. PLUS The Sun and Life in the Universe: Chapters 7 – 10:** *We apply the knowledge gained in the previous two units to explore our solar system. Starting with non-Earth terrestrial planets - Mercury, Venus, and Mars – we understand rocky worlds in general and delve into what makes each planet interesting and unique. Moving farther out in the solar system, we examine the nature of the gas giant planets - Jupiter and Saturn - and continue to the ice giants - Uranus and Neptune. If time allows, we finish our formal study of the solar system by understanding our star, the Sun.*

Lectures

The purpose of the lectures will be to elucidate to most important aspects of the material covered in the textbook. This will be done through conventional lecturing as well as the use of on-line resources via supplemental “Parallel Lectures” [See below]. This semester, I hope to pilot a series of in-class activities focused on peer discussion, inquiry, curiosity, and scientific thinking. For now, these will be only participation/attendance graded to help me hone what is most effective and concurrently develop useful evaluation metrics.

PowerPoint Slides and PDFs of the lectures will be provided prior to the beginning of each class on Canvas. **A Note on Note-taking:** This provision is NOT meant to be a replacement for note taking or class attendance [See Attendance Policy below], but rather to increase student participation and aid in exam preparation. I **HIGHLY ENCOURAGE** the taking of handwritten notes (either on printed slides or on paper), as there is an ever-growing body of research indicating improved retention using this method [See this [Scientific American Article](#)].

I will try my best to provide you all the resources you need to succeed in learning the basics of astronomy and becoming more versed in the language of science. The best learning resource, however, is yourself. You control your own learning, and the best way to do that is to engage in the material. To this end, I encourage you to seek out additional resources, study, ask questions, use the Canvas discussions and Google Hangouts, and most importantly have fun. We human are natural learners, why not let yourself enjoy it and have your mind blown about how amazing our universe is?

[Additional Course Resources](#)

Parallel Lectures via Crash Course Astronomy: The lectures are supplemented via the online resource [Crash Course Astronomy](#). In this online short-course, Dr. Phil Plait covers introductory Astronomy. This is not a replacement for my lectures, but rather an entertaining reinforcement tool and a valuable resource. The homework and exams will cover material not included in the videos. The assignment of videos will be given at the same time as the chapter reading assignments.

Canvas Discussions: While interest and activity continue, I will post interesting questions for us to discuss on Canvas. Participation is voluntary and will not affect your grade. It is, however, encouraged as it can add an extra layer of depth to the material in this course. You are also encouraged to create discussions of your own.

Astronomy 151 Google Hangout: Based on the success of a student-created *Google Hangout* a few semesters ago, I will create and host a hangout for this class. Look for the invite link in a Canvas announcement (make sure you have them enabled for this class). In the past, students used the hangout to help them study for quizzes and exams. The success of such a platform depends on your use of it. I want this to be a student-driven resource, but I will chime in with extra detail from time to time. If the discussion is lively and the hangout is used often and appropriately, I will also use this platform to give hints for those that are participating.

[Email](#)

You are required to have an official UT email address ([name@utk.edu](#) or [name@vols.utk.edu](#)) and read your email on a regular basis, since some of the needed information for this class that cannot be transmitted to you during the lectures, this information will be given to you via email. Examples of this type of information include cancellation of classes or last-minute changes in assignments. Please remember, that if you are using an existing non-UT email account (AOL, Yahoo, etc.) it is your own responsibility to re-route your UT email to your preferred account.

Emailing Your Instructor Etiquette: Please remember that your university life is a professional environment, and that I am a working professional astronomer and instructor. When emailing me, please address you emails to Dr. Lindsay or Prof. Lindsay. In the past, I have received some truly ludicrous email introductions such as, “Hey Professor Dude Bro, ...” and “Hi Sean, my name is Sean too. HaHa.” Please don’t be my next example of absurdity. Additionally, I typically have over 400 students per semester, which can lead to a lot of student emails. Before emailing me a course policy question, please check this syllabus.

Grading Scale

Your final score will be calculated using the following weights. Your lowest exam score will be dropped, and read below in the “Exams” section for further exam replacement possibilities.

Grading Weights	
First test	20%
Second test	20%
Third test	20%
Final exam (If needed to replace an exam grade)	20%
Quizzes	15%
Homework	15%
Attendance	10%
Total	100%

Grading Scale: The below grading scale is used for this course.

There is **no rounding applied to any final scores**.

Grade	Average % Range
A	> 90.00
B+	87.50 – 90.00
B	80.00 - 87.49
C+	77.50 - 79.99
C	70.00 – 77.49
D+	67.50 – 69.99
D	60.00 – 67.49
F	< 59.99

For this course, I report +’s grades, but I do not report –’s.

You are welcome to discuss the grading of a given assignment up to a week after it has been returned to you. *After a week, the score will not be changed.*

Examinations (20% per; count 3 highest)

Exams will be done via SCANTRON forms. Forms will be provided to you at the beginning of each exam. There will be three in-class exams and one final comprehensive exam. ***I will take your three highest exam scores to calculate your final average.***

The final exam is comprehensive, and it counts the same course percentage as the three in-class exams. Given equal weights, the final exam is treated the same as an in-class exam and can count

as your free dropped exam (see Exam Make-Ups below). The final exam is mostly used to provide replacement exam grades in the case of missed in-class exams or grade replacement on a low-scoring in-class exam.

Exam Make Ups: THERE ARE NO MAKE-UP EXAMS OFFERED FOR ANY EXCUSE.

Instead of scheduling innumerable make-up exams and answering even more emails, I have the following policy of replacing missed in-class exams with your grade on the comprehensive final. Given that you:

- **Miss zero in-class exams:** You can either skip the final or take it to replace your lowest in-class exam score, if you score higher on the final.
- **Miss one in-class exam** (including the final): You can take the final to replace the grade of your missed in-class exam.
- **Miss two in-class exams:** Your final exam will replace one of the missed exams at full credit, and the second missed exam at 80% credit.
- **Miss all three in-class exams:** Your final exam will replace one of the missed exams at full credit, the second missed exam at 80% credit, and the third missed exam at 60%.

All tests are closed-book tests. During tests students are required to bring a Number 2 pencil to complete the Scantron form. You are allowed to use a calculator (CELL PHONE ARE NOT CALCULATORS). No other material whatsoever will be allowed including headphones/earbuds, smart phones, laptops, etc., During the test students are not allowed to communicate with anybody else, nor are they allowed to try to see the solutions of other students (the exams are scrambled, so your test will be different from your neighbors). Any violation of these exam rules will result in the student receiving a 0 (zero) on the test. A second offense will lead to a grade of F for the course and a report to the Dean of Students and the Student Conduct and Community Standards offices.

Tentative Exam Schedule*		
Test no.	Date & Time	Expected Content
1	Wednesday, 13 Feb. 2019	Chapters 1 - 3
2	Friday, 15 March 2019	Chapters 4, 5 & 6-Earth
3	Monday, 22 April. 2019	Chapters 6-Moon, 7 & 8
Final	Friday, 3 May from 12:30 – 2:30 PM	Comprehensive (all chapters)

Quizzes [Quiz Average is 15% of Course Grade]

There will be six (6) in-class quizzes throughout the semester. The purpose of these quizzes is to encourage attendance, check current levels of understanding, and help you prepare for the exams. *All quizzes are graded out of 10 points, and the lowest quiz grade of the 6 in-class quizzes is dropped.* Three of the quizzes will have an extra 11th question. The extra question is a challenge question and is mixed in with the rest of the questions. This gives you the possibility of earning up to 53 quiz points for the semester, where 50 quiz points is a 100%.

Quiz Make Ups: Students are only allowed to make up a quiz if they provide an notification of absence approved and sent out by the Dean of Student's office (<https://dos.utk.edu/>). I need to be informed of the absence by the day following the missed quiz and all quizzes must be made up within 1 week of the original quiz date.

Homework (15% of overall grade)

Homework in this class is done through W. W. Norton's online platform, Smartwork5, and a few *You must access Smartwork5 through this course's Canvas site, which is found under the Modules tab. **DO NOT TRY TO ACCESS SMARTWORK5 DIRECTLY FROM THE W.W. NORTON WEBSITE.***

Your textbook comes with a SmartWork5 registration code, but due to a grading error that the Smartwork5 developers have been unable to yet correct, access to Smartwork5 this semester is free. This means you can save money by renting or buying a used book.

Homework assignments are announced at the beginning of each class. The assignments are listed on the THIRD slide of the Lecture Slides. If you miss class, please check this slide for your missed assignments.

The final score for homework will be calculated as a percentage of total points earned points versus the total obtainable points. The homework score will count 15% towards the final course grade.

Late Homework Policy: Late Homework assignments can still be completed for credit. There will be a 5% reduction per day for up to 20 days.

Advice for Homework Success: My homework assignments are designed to reinforce course concepts, and as such, similar questions will appear on the exams. I also design my homework assignments to be the easiest way for you to earn a high grade in this class, so ***make sure you do all the assignments!*** Smartwork5 is an online platform, which means it has both benefits and detriments, specifically point deductions for incorrect guesses. The best advice I have to earning a good homework grade is to slow down and take your time with each question. Do not simply start guessing and incur the point penalties. Use my lectures and your textbook to feel confident about your answer before submitting. Once completed, all homework assignments can be reworked for practice to help study for exams.

Warning to Group Me, Chegg etc. Homework "Collaboration": I am well aware that Group Me, Chegg, etc. are popular platforms for students to share homework answers. Taking pictures of answered homework questions and sharing them via a social media platform is a form of cheating. While difficult to catch, I am on the lookout for it, and I will have a few anonymous "student plants" in the course who will report to me if Group Me, etc., is being used for homework cheating. If I find out this is occurring, I will reduce all offenders' maximum homework average to a maximum of 75% in the first case and apply my other standard cheating consequences [See "Honor Statement, Collaboration, Cheating, and Plagiarism" section below]. If caught more than once, I will contact the Office of Student Conduct for violations of the Student Code of Conduct & Honor Statement. If you are not removed from the

university or if I am advised to not fail you, your homework will not count towards your final grade, and the additional 15% will be distributed amongst your three counted exams (making each exam worth 25% of your overall grade).

Attendance (10% of Course Grade)

Attendance counts 10% of your final grade in the course. Student attendance will be monitored via **TEN “Notecard Questions”** asked during class throughout the semester. Every student can miss **TWO** notecard questions with no penalty applied to your final Attendance Grade. **Every notecard missed after two will negatively affect your Attendance grade in the course.** The attendance grading scale is:

# NCQs	Grade	Comment
10	100.0+	+2% to final average
9	100.0	
8	100.0	
7	90.0	
6	77.5	
5	65.0	
4	52.5	
3	37.5	
2	22.5	
1	10.0	
0	0.0	

Answering all ten notecard questions will earn you +2% to your final average.

The “Notecard Questions” are meant to be fun questions and will not be graded on correctness. In fact, there will be no correct answer to a notecard question. The questions will all be lighthearted or designed to engage you with the course material in ways that I cannot otherwise monitor given the course structure.

Extra Credit (added to final average)

I offer up to +5% on your final average in this class, which can be earned through attending extra credit sessions and completing a write-up on the experience.

All of the extra credit sessions are designed to get your eye to a telescope, experience the night sky via observations or our planetarium, and to reinforce course content through full-dome films and demonstrations in our planetarium. Each attended session earns you +1% on your final average with a cap at +5% in total from the extra credit sessions (This cap does not apply to the +2% for perfect attendance. Achieve both, and you earn +7% on your final average).

The following options for extra credit are available:

1. Night observations (1 point per session, can attend 2 session)
2. Day observations (1 point per session, can attend 2 sessions)
3. Planetarium sessions* (1 point per session, can attend 1 planetarium show & 2 planetarium films)
4. Trip to a space science museum, star party, or other planetarium² (1.5 points per)

* No duplicate sessions will be counted toward extra credit.

The MAXIMUM NUMBER OF EXTRA CREDIT POINTS THAT WILL BE COUNTED TOWARD YOUR FINAL AVERAGE IS +5%. Note, the perfect attendance extra credit is added in addition to the +5% for a maximum total of +7%.

Staggered EC opportunities: Past experience has taught me that the last 2 weeks of class always sees a surge of people seeking out extra credit. My observation is that most of the time these are students inherently interested in going above and beyond what is necessary in the course, and hence truly earning extra credit. Instead, this bonus-point-rush is people trying to save their grade without really supplementing their knowledge. This is antithetical to the purpose of extra credit sessions. In response, I have the following policy with extra credit sessions:

- *Prior Monday, 25 March 2019 students can earn up to +5% in any of the ways listed above.*
- *Starting Monday, 25 March 2019 any student can only earn an additional +2.5%* of extra credit. *If you attend 3 sessions during this period, you will earn +2.5% instead of the normal +3%.*

What to do to earn your Extra Credit (EC) in brief:

For details, please see the Extra Credit Information document on Canvas under the Syllabus tab.

To attend and receive credit for a session, you need to do the following:

1. **Sign up** on our sign-up sheets that are posted weekly outside of Room 108 in Nielsen Physics and Astronomy.
2. **Attend your session.** You only need to bring something to write with and on. At the session, you will be given an EC session form. Complete the form as instructed and get your EC form stamped by Mr. Lewis.
3. **Do an EC session write-up**³. Staple your stamped EC session form to your type and printed write-up and turn that packet into your instructor within two weeks of your session.

Reading Check Every semester, I spend endless hours answering student emails that have their answers contained here in this wonderful syllabus. This leads me to think that most people never

² You must provide proof of your visit. A selfie at the location will suffice

³ 1-page single-spaced for day, night, and planetarium sessions. 1.5 to 2 page single-space for planetarium films. 2 page single-space for trip to a space science museum, star party, or outside planetarium.

actually read this, so I offer the diligent student the following opportunity. I am an enthusiast of urban studies and understanding human society; I find these academic fields endlessly fascinating. As a course of study, understanding the spaces humans occupy and how they interact with each other and their environments offers the potential to address many of the most pressing questions and issues we face as humans living in organized societies. One thing I particularly enjoy is finding those special places in a city that have meaning to individuals or groups. I offer you +3 quiz points (to be added to the total number of quiz points earned this semester) if you go to a place in Knoxville and take a picture of yourself at your favorite “Knoxville spot” (that isn’t a residence). The “Knoxville spot” needs to be a place that is special to you and adds to the culture of Knoxville as a city. To receive the points, you must be holding up a sign that reads “My Knoxville Spot” and email me the picture with your name, the location, whether you in the MWF or TR section, and, most importantly, what makes it your “Knoxville spot”. To receive your points, you must complete this task by 30 January 2019.

Honor & Statement, Collaboration, Cheating, and Plagiarism

As a student in this class you are highly encouraged to interact with other students concerning understanding the material. However, this interaction must be at a level where it increases your general knowledge of astronomy. It can never cross the level to actual plagiarism or cheating. If I judge you have copied other sources (online or other students), found to be cheating on a quiz or exam (e.g., looking at another paper, using prohibited materials, etc.), or you have aided others in plagiarizing your work, you will receive a 0 (zero) score on the assignment, quiz, or test and your final grade will be reduced by a letter grade (A will be B etc.). A second offense will lead to a grade of F for the course and a report to the Dean of Students and Office of Student Conduct and Community Standards.

Problems with Social Media Apps & Internet Services: In the past semesters, I have dealt with large number of students using Group Me, Chegg, and Google Drive (and other similar services) to take pictures of homework questions and share them with other students, as well as arrange ways to cheat on attendance notecard questions [In one case, one student was offering another student Chik-fil-A in exchange for falsifying their attendance status. Such a bribe puts both parties’ future at UTK at risk, and for what, a chicken sandwich?].

Some of you may not see this as cheating, but rather, as a form of research to get the right answer. However, in my opinion, *this is a form of cheating* as it undermines the goals of comprehension, learning, and critical thinking. Not only is it physically cheating to get the right answers this way, but it is also cheating yourself. Being told the right answer is not what education is about. Education is about learning how to discover the right answer, realizing there might not be a “right” answer, and developing the desire and know how to get you towards an answer. This is especially true in the sciences. Bypassing this opportunity to truly learn and better yourself undercuts your education and your ability to learn in this class and others. As an educator and academic that cares deeply about helping students, inspiring the public, education, and helping to produce a better world, I will not tolerate this behavior.

Fighting this is somewhat akin to trying to grab smoke, but I will try my hardest to prevent this from happening in this class. To this end, I will have “student plants” in the class that will report to me if a Group Me, Google Drive, etc., crosses the line into cheating. Cheating constitutes taking pictures of correct homework answers and sharing them, having someone turn in Note

Card Questions for you, putting exact copies of any of my materials on Chegg or other so-called “study” platforms, or anything that is obviously worse than those violations.

In the case you and others are caught, I will reduce all offenders’ maximum homework/attendance average to a maximum of 75% in the first case and apply my other standard cheating consequences. If caught more than once, I will contact the Office of Student Conduct for violations of the Student Code of Conduct & Honor Statement. If you are not removed from the university or if I’m advised to not fail you, your homework/attendance will not count towards your final grade, and the missing percentages will be distributed into your exam weights (if homework, each exam becomes 25%; if attendance, each exam becomes 23.33%)

In response to this problem (which is hopefully one of the past), I will be active in the Canvas Discussion sections of this course, and I will also create a Google Hangout for you all to discuss materials and study for exams. I highly encourage you to make use of those resources.

Disability Students & Student Disability Services

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Additionally, please contact Student Disability Services (SDS) at 865-974-6087 in 2227 Dunford Hall to coordinate reasonable accommodations for students with documented disabilities.