AST 301, Introduction to Astronomy

Course Description and Syllabus — Fall 2019

Unique Number:	45940
Lecture Time:	MWF 9:00 - 9:50 AM
Lecture Location:	PAI 3.02
Instructor:	Dr. Edward L. Robinson Dept. of Astronomy, UT Office: Physics/Math/Astronomy Bldg (RLM) 17.318 Office Hours: Wednesday, 2:00 - 3:00 PM Other hours by appointment
Textbook:	"Astronomy" by A. Fraknoi, D. Morrison, & S. Wolf. This is a free OpenStax ebook. You can download it from the course web site or from http://openstax.org/details/books/astronomy
Course Email:	Send email via Canvas
Course WEB Site:	https://www.as.utexas.edu/~elr/AST301-Fall
Teaching Assistants:	Alicia Montecinos Office & Office Hours: See "Office Hours" on course web page.
	Rui Wang Office & Office Hours: See "Office Hours" on course web page.

Course Description: AST 301 is a one-semester introduction to astronomy for non-science majors. No previous course in astronomy is required. The main topics of the course are:

- The solar system – the planets and their moons, asteroids, comets.
- Stars and stellar evolution – star birth and the formation of planets, and star death, including neutron stars, black holes, supernovae.
- Galaxies – normal and not-so-normal galaxies, quasars and supermassive black holes, dark matter.
- Cosmology – the expansion of the universe, its origin in the Big Bang, dark energy and the future of the universe.

The course emphasizes the physical processes at work in the universe and the methods we use to learn about the universe.

The course often requires mathematics at the level of first-year algebra. If you are uncomfortable with this level of mathematics, you should consider a different section of AST 301.

Course Organization: The textbook and the lectures are the primary sources of course content. Attendance at the lectures is not required but you need attend them regularly anyway because (1) the lectures will sometimes cover material not in the textbook, (2) there will be a 10-minute exam every Friday, and (3) there will be mini-quizzes during most of the other lectures. The mini-quizzes will not be announced beforehand, so the only way to insure that you take all of them is to attend all the lectures.

There is a web site for the course containing the following information:

- Organizational material for the course, including the course description and syllabus, the course calendar, and times of office hours and help sessions.
- Content material for the course, including a copy of the textbook, lecture notes, and pdf versions of the powerpoint slides shown during lectures.
- Homework Assignments.
- Answers to homework and exam questions.

The are a variety of ways to get additional help in the course. (1) Both Dr. Robinson and a TAs hold regularly scheduled office hours. You may visit us during office hours for any reason without an appointment. You can come at other times also, but make an appointment so that you can be sure to catch us. (2) You can contact us by email through Canvas. (3) We offer non-compulsory help sessions. These help sessions are smaller and have a much less formal environment than the lectures. They are unstructured but are usually devoted to help on the material covered in the lectures and textbook. It is impossible to give everyone as much personal attention during the regular lectures as they may need – the class is too large. The help sessions are the best place to get personal attention. The help sessions are also an excellent way to get help with the homework problems.

The Sanger Learning Center: All UT students are welcome totake advantage of the Sanger Centers classes and workshops, private learning specialist appointments, peer academic coaching, and tutoring for more than 70 courses in 15 different subject areas. For more information, visit http://www.utexas.edu/ugs/slc or call 512-471-3614 (JES A332).

Dr. Robinson might miss some classes during the term because of travel to McDonald Observatory or scientific meetings. Other instructors will teach the class during his absence and will cover the material he would have covered, but if having the same instructor throughout the term is important to you, you should consider switching to a different section of AST 301.

Course Grade: Your course grade will be based on examinations, homeworks, and mini-quizzes.

Exams: There will be an exam every Friday and a comprehensive final exam during the regular final examination week. The Friday exams will generally consist of 10 multiple-choice questions covering material from the previous week and will last 10 minutes.

The final exam will be Wednesday, December 18 at 9:00 AM (the time of the final exam is set by the Registrar, not the course instructor). You are not required to take the final exam! It serves as a combination make-up exam and second-chance exam. If you choose to take it, your score on the final will replace up to three of your worst scores on the Friday exams. There will be absolutely no other make-up exams, no matter how good your reason for missing the exam; the final-exam policy covers situations where exams are missed for legitimate reasons. Taken together the exams count for 70% of your final grade.

Homework: There will be a homework assignment every week. The homework assignments are generally due on Wednesdays and can be downloaded from the course web site at least one week before they are due. Taken together they will count for 15% of your final grade. Homework scores may not be dropped and replaced by the final exam score.

Mini-Quizzes: There will be a mini-quiz at the end of nearly every lecture. The mini-quizzes are open-book and everyone can work together on them, so ideally everyone should get good scores on the mini-quizzes. Together the mini-quizzes will count for 15% of your final grade. You may miss

up to four mini-quizzes without penalty, but any missed beyond that will be recorded as zeroes in the grade book and the zeroes may not be replaced by the final exam score.

The letter grade will be assigned on the following absolute scale:

Numerical Grade (Percent)	Letter Grade	Numerical Grade (Percent)	Letter Grade
83.00 to 100.0	A	57.00 to 59.99	D+
80.00 to 82.99	A−	53.00 to 56.99	D
77.00 to 79.99	B+	50.00 to 52.99	D−
73.00 to 76.99	B	00.00 to 49.99	F
70.00 to 72.99	B−		
67.00 to 69.99	C+		
63.00 to 66.99	C		
60.00 to 62.99	C−		

In past years the average course grade has been mid-B.

The Fine Print

Cheating, Plagiarizing, and Other Miss-Behavior: This course assumes that you are familiar with and abide by the official university policy on student conduct and academic integrity (see the university web site http://deanofstudents.utexas.edu/conduct/). The penalty for cheating on an exam is a score of zero for the exam and the zero will be included as one of the exam scores used to calculate your final grade. Persistent misbehavior will be reported to the Dean of Students.

Students with Disabilities: Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259 (web site http://diversity.utexas.edu/disability/about/).

Core Curriculum Statement: This course may be used to fulfill three hours of the natural science and technology, Part I component of the university core curriculum and addresses the following four core objectives established by the Texas Higher Education Coordinating Board: communication skills, critical thinking skills, teamwork, and empirical and quantitative skills.

Religious Holidays: By UT Austin policy, you must notify the professor of a pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.

Department of Astronomy Ground Rules: The Department of Astronomy has ground rules for all its undergraduate courses. They are described in the document "Memo to Undergraduate Astronomy Students Regarding Astronomy Courses," which is available online at

http://www.as.utexas.edu/astronomy/education/memo.html

Astronomy 301 Course Syllabus
Fall Term 2019

Section	Contents	Lecture Number	Tentative Date	Textbook Chapters
I.	Course Organization			
	a) course description	1	08/28/2019	1
	b) course syllabus			
	c) math review			
	d) course grade			
II.	Planetary Motion and Gravity			
	A) Scale of the Solar System	2	08/30/2019	1
	a) sizes and distances in the solar system			
	B) Overview of the Solar System	3	09/04/2019	1 & 7
	a) contents of the solar system			
	b) patterns in the properties of the planets			
	c) motions of the planets			
	C) Kepler's Laws of Planetary Motion	4	09/06/2019	2 & 3
	D) Newton's Law of Gravity	5	09/09/2019	3
	a) force, mass, weight			
	b) Newton's Law of Gravity			
	c) orbital motion			
	d) Kepler's third law revised			
III.	The Solar System			
	A) The Earth	6	09/11/2019	8 & 9
	a) interior of the Earth			
	b) tectonic activity			
	c) age of the Earth			
	d) Evolution of the Earth's Atmosphere			
	B) Mars	7	09/13/2019	10
	a) surface of Mars			
	b) water on Mars			
	c) atmosphere of Mars			
	d) life on Mars			
	C) Jupiter	8	09/16/2019	11 & 12
	a) interior of Jupiter			
	b) atmosphere of Jupiter			
	c) Galilean moons of Jupiter			
	D) Smaller Members of the Solar System	9	09/18/2019	13 & 14
	a) asteroids			
	b) comets			
	c) Kuiper belt and Oort cloud			
	d) things that hit the Earth			

Section	Contents	Lecture Number	Tentative Date	Textbook Chapters
IV.	The Properties of Stars			
	A) The Distances of Stars	10	09/20/2019	18 & 19
	a) annual parallax			
	b) other ways to measure distance			
	c) the nearest stars			
	d) the brightness and luminosity of stars			
	B) Waves	11	09/23/2019	5
	a) the wave nature of light			
	b) speed, wavelength, frequency			
	C) The Physics of Light	12	09/25/2019	5
	a) electromagnetic spectrum			
	b) temperature			
	c) black body radiation			
	D) The Hertzsprung-Russell Diagram	13	09/27/2019	17 & 18
	a) the temperatures of stars			
	b) the H-R diagram			
	c) the types of stars			
	d) the radii and densities of stars			
	E) The Chemical Composition of Stars	14, 15, 16	09/30/2019	5 & 17
	a) the nature of atoms		to	
	b) the particle nature of light		10/04/2019	
	c) Kirchhoff's laws			
	d) the spectra of stars			
	e) the composition of stars			
	F) The Masses of Stars	17	10/07/2019	5, 17 & 18
	a) binary and multiple stars			
	b) the Doppler shift			
	c) spectroscopic and eclipsing binaries			
	c) the masses of stars			
	G) Variable Stars	18	10/09/2019	17 & 19
	a) eclipsing and spotted stars			
	b) pulsating variables			
	c) supernovae			
	d) pulsars and neutron stars			
V.	The Structure and Evolution of Stars			
	A) Physics of Stellar Interiors	19, 20	10/11/2019	16
	a) nuclear energy; fission and fusion		and	
	b) important nuclear reactions in stars		10/14/2019	
	c) gravity and pressure balance			
	d) energy flow and temperatures			
	e) the structure of main-sequence stars			
	B) The Sun – A Typical Main-Sequence Star	21	10/16/2019	15

Section	Contents	Lecture Number	Tentative Date	Textbook Chapters
V.	The Structure and Evolution of Stars (continued)			
	C) Interstellar Matter and Star Formation	22	10/18/2019	20 & 21
	a) interstellar gas and dust			
	b) star formation			
	c) open clusters and associations			
	D) The Origin of Planetary Systems	23	10/21/2019	21
	a) planets around other stars			
	b) origin and evolution of planets			
	E) The Evolution of Low Mass Stars	24, 25	10/23/2019	22
	a) main-sequence evolution		and	
	b) evolution up the Giant Branch		10/25/2019	
	c) evolution on the Horizontal Branch and the Asymptotic Giant Branch			
	d) planetary nebulae and white dwarfs			
	e) the H-R diagram of clusters			
	f) cluster ages			
	F) The Evolution of High-Mass Stars	26, 27, 28	10/28/2019	22, 23, & 24
	a) core-collapse supernovae and the formation of neutron stars		to 11/01/2019	
	b) the origin of the heavy elements			
	c) relativity and black holes			
	d) the evolution of binary stars			
	e) black holes in binary stars			
VI.	Galaxies and Quasars			
	A) The Milky Way	29	11/04/2019	25
	a) the disk, halo, and spiral arms			
	b) rotation and mass of the Galaxy			
	c) history of the Galaxy: age, metallicity, and populations			
	B) Normal Galaxies	30, 31	11/06/2019	26
	a) classification of galaxies		and	
	b) properties of elliptical galaxies		11/08/2019	
	c) properties of spiral galaxies			
	d) evolution of galaxies			
	C) Peculiar Galaxies and Galaxy Clusters	32	11/11/2019	28
	c) dwarf and starburst galaxies			
	a) collisions and interactions			
	b) clusters and large scale structure			
	c) effect of environment on evolution			

Section	Contents	Lecture Number	Tentative Date	Textbook Chapters
VI.	Galaxies and Quasars (continued)			
	D) Distances and Hubble's Law	33	11/13/2019	26
	a) measurement of distances			
	b) the radial velocity of galaxies			
	c) Hubble's Law and its meaning			
	E) QSOs and Active Galactic Nuclei	34, 35	11/15/2019	27
	a) the observational properties of QSOs		and	
	b) the unified model for QSOs		11/18/2019	
	c) active galactic nuclei and QSO evolution			
	d) quiescent supermassive black holes			
VII.	Cosmology			
	A) Introduction to Cosmology	36	11/20/2019	29
	a) the basic properties of the universe			
	b) the expansion of the universe			
	c) the age of the universe			
	B) The Hot Big Bang model	37	11/22/2019	29
	a) the cosmic microwave background			
	b) the primordial chemical composition			
	Special Lecture		11/25/2019	
VII.	Cosmology (continued)			
	C) Modern Cosmology	38, 39	12/02/2019	28 & 29
	a) inflation		and	
	b) formation of structure		12/04/2019	
	D) The Future of the Universe	40, 41	12/06/2019	28 & 29
	a) the geometry of the universe		and	
	b) dark matter and dark energy		12/09/2019	
	c) the future of the universe			