University of South Carolina
Carolina Core

ASTRONOMY 101
INTRODUCTION TO ASTRONOMY

BULLETIN INFORMATION

ASTR 101 – Introduction to Astronomy (4 credit hrs)

Course Description:

An introduction to the solar system and universe accomplished with interactive lectures, demonstrations, and laboratory experience. Designed primarily for the non-science major.

SAMPLE COURSE OVERVIEW

Astronomy 101 is an interactive lecture course with a laboratory for students without any scientific background. The lectures cover material in three basic areas of astronomy: the celestial globe and the historical development of heavenly observations; our solar system including planets, moons and the sun; and stellar evolution, our galaxy and the big bang. The goal of the course is to excite and inform participants about the vast nature of the universe in which we live.

ITEMIZED LEARNING OUTCOMES

Upon successful completion of ASTR 101, students will be able to:

1. Demonstrate an understanding of the basic principles and vocabulary of astronomy.
2. Describe our location in the Universe and explain the relevant observational evidence.
3. Describe and quantify the motions of the planets and their physical interpretation in terms of mechanics and gravity; describe how that understanding emerged historically.
4. Discuss and interpret physical properties of the Sun.
5. Interpret properties of the interstellar material and the Milky Way using available data.
6. Describe and quantify the basic phenomena involving light and spectroscopy.
7. Demonstrate an understanding of the scientific method by testing hypotheses through experimentation and observation.

SAMPLE REQUIRED TEXTS/SUGGESTED READINGS/MATERIALS

1. The required text for the course is *Astronomy, A Beginners Guide to the Universe*, Seventh Edition, Chaisson and McMillan, 2013, Pearson Education Inc. (Glenview, Il). ISBN 978-0-321-81535-4.
2. Along with the physical textbook purchase, students will have on-line access to the Mastering Astronomy web site – www.masteringastronomy.com - that has an electronic version of the textbook and video tutorials.
3. "i>clicker2's" are required for this class and will be employed during each lecture. They can be purchased new from the bookstore or used from students

SAMPLE ASSIGNMENTS AND/OR EXAMS

- **Class Participation and i>clickers**: Throughout the lectures, students will be asked questions on the astronomy topics presented and covered in the reading material as outlined in the lecture timetable. The students will work in self-selected peer groups to answer the questions using i>clickers. These groups will engage in discussions and problem solving that require critical thinking. These in-class questions then provide real-time feedback and allow the students to demonstrate their understanding of the basic terminology, principles, and concepts of astronomy. Based on the answers to the questions, the lecture will be tailored to address in more detail areas of difficulty for the students.
- **Homework**: Weekly homework assignments will consist of conceptual and numerical problems that accompany each chapter under discussion. Completion of these problem sets will require students to demonstrate a deeper understanding of the topics in both qualitative and quantitative fashion. Problem sets are to be completed each week as designated on the course timetable. Answers will be made available the next day. The LON-CAPA homework system will be used.
- **Tests:** The three tests for the class will include both conceptual and numerical problems. The tests will consist of conceptual questions as well as problem solving questions. These tests will be closed-book style. Successful completion of the tests will demonstrate mastery of the basic terminology, principles, and concepts of astronomy.
- **Final Exam**: The final exam is comprehensive and will cover all material covered in class.
- **Laboratory Exercises (8):** The laboratory component of this course is designed to introduce the student to the scientific method though hands-on activities. Each laboratory exercise will require critical thinking and encourage the students to form hypotheses and test their ideas through experimentation. The laboratory exercises described below will reinforce the topics covered in the lecture and are listed on the lecture timetable.
    - Lab 1) The Celestial Globe – Students will discover how to visualize the horizon and equator coordinates and demonstrate how these coordinates relate to the stars and Sun.
    - Lab 2) Time and the Celestial Globe – Students will investigate and demonstrate how the three types of astronomical times are defined and how they are interrelated.
    - Lab 3) Telescopes – Students will construct a simple refracting telescope and demonstrate the operation of a reflecting telescope.
    - Lab 4) Interpretation of Lunar Data – Students will demonstrate an understanding of some of the techniques used to study our nearest neighbor, the Moon. The three major parts of this laboratory exercise consist of determining the heights of lunar craters and the circumstances of two lunar eclipses.
    - Lab 5) Luminosity and Magnitude – Students will calibrate and operate a simple photometer scale. They will investigate how magnitudes are determined from star-field photographs.
    - Lab 6) The H-R Diagram – Students will demonstrate an understanding of spectra and their use for stellar classification. Students will observe and examine spectra

from different stellar classes and determine the best processes to use when determining stellar distances.

- Lab 7) The Measurement of Distances - "How do we know how far away or how large is an astronomical object?" In this laboratory, students will investigate some aspects of this question. In particular, students will use angle measurements, triangulation, distance measurement by radar techniques, and finally the indirect methods to determine the distances to galaxies.
- Lab 8) The Milky Way – Students will examine the distribution of novae and deduce the location of the center of our Galaxy, examine the distribution of globular clusters and determine the distance to the galactic center, and how the spiral structure is determined from the radio data of the distribution of neutral hydrogen gas.

SAMPLE COURSE OUTLINE WITH TIMELINE OF TOPICS, READINGS/ ASSIGNMENTS, EXAMS/PROJECTS

Week	Class	Topic	Reading (Chapter)	Homework	Laboratory
1	Class 1	Charting the Heavens	0		
2	Class 2	The Copernican Revolution	1	HW1	The Celestial Glo
	Class 3	The Copernican Revolution			
3	Class 4	Light and Matter	2	HW2	
	Class 5	Light and Matter			
4	Class 6	Telescopes	3	HW3	Time and the Cel Globe
	Class 7	Telescopes			
5	Class 8	Telescopes		HW4	
	Class 9	**Test 1**			
6	Class 10	The Solar System	4		Telescopes
	Class 11	The Solar System			
7	Class 12	Earth and Its Moon	5	HW5	
	Class 13	Earth and Its Moon			
8	Class 14	The Planets	6 and 7	HW6	Interpretation of Data
	Class 15	The Planets			
9	Class 16	The Sun	9	HW7	
10	Class 17	The Sun		HW8	Luminosity and M
	Class 18	**Test 2**			
11	Class 19	Stars: Giants, Dwarfs etc.	10		
	Class 20	Stars: Giants, Dwarfs etc.			
12	Class 21	Interstellar Medium	11	HW9	The H-R Diagram
13	Class 22	Stellar Evolution	12	HW10	
	Class 23	Stellar Evolution			

14	Class 24	The Milky Way	14	HW11	The Measureme Distance
	Class 25	The Milky Way			
15	Class 26	**Test 3**			
16	Class 27	Cosmology : The Big Bang	17	HW12	The Milky Way
	Class 28	Cosmology : The Big Bang			
		Final Exam according to University exam schedule			