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Astronomy (ASTR) 1511 Introduction to Astronomy with Lab (4 Units) CSU:UC

Advisory: English 1000, Reading 1005, and Math 1050 strongly recommended.

Prerequisite: None

Total Hours: 48 hours lecture; 48 hours lab (96 total hours)

Catalog Description: This survey course includes historical development of astronomy; astronomical instruments; basic physical laws and processes; the formation, life cycle and death of stars; the structure and dynamics of the Milky Way galaxy and other galaxies, and the structure of the universe; cosmology; and the evolution and structure of the solar system. Field trips are required to study points of astronomical interest. The student may opt to receive credit in only one of the following courses: Astronomy 1510 or Astronomy 1511.

Type of Class/Course: Degree Credit

Text: Bennett, Jeffrey, et al. *The Cosmic Perspective*. 8<sup>th</sup> ed., Addison-Wesley, 2017.

Additional Required Materials:

Bennett, Jeffrey, et al. *Mastering Astronomy with eText- Standalone Access Card- for The Cosmic Perspective*. 8<sup>th</sup> ed. Addison-Wesley. 2017.

Astronomy 1511 Laboratory Manual. 2020.

Course Objectives:

By the end of the course, a successful student should be able to

1. provide a descriptive overview of the contents of the universe, with secondary emphasis on the solar system, and identify the type of astronomical object shown in selected photographs,
2. demonstrate a qualitative understanding of the processes occurring in stars, galaxies, interstellar matter and the solar system, and of the basic physical laws that govern these processes,
3. develop the ability for logical scientific thought to the point of applying the physical and geometric principles discussed to the analysis and qualitative solution of simply stated astronomical problems. As far as possible, considering the level of the course, this objective will be emphasized relative to the memorization of facts, and
4. develop an understanding of scientific inquiry and the scientific method through examples drawn from the history of astronomy, and develop an appreciation of the crucial role of astronomy in the development of modern science.



Course Scope and Content (Lecture):

- Unit I            Grand Tour of the Heavens
  - A.     Astronomers tools
  - B.     Constellations
  - C.     Stellar measurements
  - D.     Origins
  - E.     Science versus pseudoscience
  
- Unit II           Electromagnetic Radiation
  - A.     Electromagnetic radiation
  - B.     Black body radiation
  - C.     Absorption and emission spectra
  - D.     Properties of matter
  - E.     Doppler effect
  
- Unit III          Optics and Telescopes
  - A.     Eyes and cameras
  - B.     Refracting telescopes
  - C.     Reflecting telescopes
  - D.     Schmidt telescope
  - E.     Ground based telescopes and satellites
  
- Unit IV          Motion of Stars and Planets
  - A.     Phases of the moon
  - B.     Solar and lunar eclipses
  - C.     Apparent magnitude
  - D.     Celestial sphere
  - E.     Celestial coordinates
  - F.     Seasons, time zones and calendars
  
- Unit V           History of Astronomy
  - A.     Ancient roots of science
  - B.     Aristotle
  - C.     Ptolemy
  - D.     Copernicus
  - E.     Brahe
  - F.     Kepler
  - G.     Galileo
  - H.     Newton
  
- Unit VI          The Solar System
  - A.     Terrestrial planets
  - B.     Jovian planets
  - C.     Pluto and Charon
  - D.     Asteroids
  - E.     Comets
  - F.     Other solar systems
  - G.     Formation of our solar system
  
- Unit VII         Our Sun
  - A.     The Sun's basic structure

- B. Hydrogen fusion and neutrinos
- C. Sunspots and other solar activity

- Unit VIII Distant Stars
- A. Color, temperature and spectra of the stars
  - B. Stellar classification
  - C. Stellar parallax
  - D. The inverse square law
  - E. Hertzsprung-Russell diagrams
  - F. Star sizes
  - G. Binary stars
  - H. Mass – luminosity relation
  - I. Variable stars
  - J. Star clusters

- Unit IX The Birth and Death of Stars
- A. Starbirth
  - B. Nuclear fusion
  - C. Brown dwarfs
  - D. The death of stars
  - E. Black holes

- Unit X Galaxies
- A. The Milky Way Galaxy
  - B. A Universe of Galaxies
  - C. Dark matter
  - D. Hubble's Law
  - E. Quasars and active galaxies
  - F. Cosmology

Course Scope and Content (Laboratory):

- Unit I Basic Astronomy Skills
- A. Position and Star Charts
  - B. Seasons and Motions of Stars and Planets
- Unit II Fundamentals of Astronomy
- A. Kepler's and Newton's Laws
  - B. Parallax and Distance
- Unit III Nature of Light in Astronomy
- A. Electromagnetic Spectrum of Light
  - B. Absorption and Emission Spectra
  - C. Properties of Waves
- Unit IV Telescopes
- A. Properties and Design of Telescopes
  - B. Optics and Imaging



- Unit V            Solar and Lunar Observing
- A.     Observing the Sun
  - B.     Observing the Moon and Lunar Phases

- Unit VI           Planets
- A.     Terrestrial Planets
  - B.     Jovian Planets
  - C.     Exo-Planets

- Unit VII          Stars
- A.     Blackbody Radiation
  - B.     Hertzsprung-Russell Diagram
  - C.     Extreme Stars

- Unit VIII        Galaxies and Cosmology
- A.     Classification and Distribution
  - B.     Origins and Scale of the Universe

Outside Activities:

The students in this class will spend a minimum of 6 hours per week outside of the regular class time doing the following:

1.     Studying text, chapter handouts and learning objectives.
2.     Answering questions.
3.     Skill practice.
4.     Completing required reading.
5.     Problem solving activity or exercise.
6.     Written work.

Methods of Instruction:

1.     Assign reading topics in the text book and selected references
2.     Class lectures will be used to clarify and extend the theoretical and factual concepts present in the text
3.     Class discussions and problem solving sessions
4.     Audiovisual materials, relative to some unit of study will be shown to supplement lecture materials
5.     Problem sets and questions from the text will be assigned
6.     Telescopic and non-telescopic visual observations will be employed so that students may see some of the objects that are emphasized in the lectures
7.     Field Trips

Methods of Evaluation:

1. Substantial writing assignments including:
  - a.    Essay exams
  - b.    Research reports
2. Computational or non-computational problem-solving demonstrations including:
  - a.    Exams
  - b.    Homework problems



c. Quizzes

3. Other examinations, including:
  - a. Multiple choice
  - b. Matching items
  - c. True/false items
  - d. Completion

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.

1. Curriculum development for each lab.
2. Published schedule of individual laboratory activities.
3. Published laboratory activity objectives.
4. Published methods of evaluation.
5. Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies.

During laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is physically present in lab when students are performing lab activities.
2. Instructor is responsible for active facilitation of laboratory learning.
3. Instructor is responsible for active delivery of curriculum.
4. Instructor is required for safety and mentoring of lab activities.
5. Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practical's, notebooks, portfolios, etc.) that become a component of the student grade that cover the majority of lab exercises performed during the course.
2. Instructor is responsible for supervision of laboratory clean up of equipment and materials.

Supplemental Data:

TOP Code:	191100: Astronomy
SAM Priority Code:	E: Non-Occupational
Distance Education:	Online; Offline
Funding Agency:	Y: Not Applicable(funds not used)
Program Status:	1: Program Applicable
Noncredit Category:	Y: Not Applicable, Credit Course



Special Class Status:	N: Course is not a special class
Basic Skills Status:	N: Course is not a basic skills course
Prior to College Level:	Y: Not applicable
Cooperative Work Experience:	N: Is not part of a cooperative work experience education program
Eligible for Credit by Exam:	E: Credit By Exam
Eligible for Pass/No Pass:	C: Pass/No Pass
Taft College General Education:	CSB1: CSU Area B1 CSB3: CSU Area B3 IG5A: IGETC Area 5A IG5C: IGETC Area 5C LNS: Local GE Natural Science