ASTRON 3 Course Outline as of Fall 2021

CATALOG INFORMATION

Dept and Nbr: ASTRON 3 Title: STELLAR ASTRONOMY
Full Title: Stellar Astronomy
Last Reviewed: 1/25/2021

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	6	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 157.50

Title 5 Category:	AA Degree Applicable
Grading:	Grade or P/NP
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
A description of the universe, concentrating on celestial bodies and phenomena beyond the Solar System. Topics will include: electromagnetic radiation, observed properties of stars, variable and binary stars, stellar evolution, black holes, relativity, the interstellar medium, star clusters, the Milky Way and other galaxies, cosmology, and the possibility of other life forms in the universe.

Prerequisites/Corequisites:

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: A description of the universe, concentrating on celestial bodies and phenomena beyond the Solar System. Topics will include: electromagnetic radiation, observed properties of stars, variable and binary stars, stellar evolution, black holes, relativity, the interstellar medium, star clusters, the Milky Way and other galaxies, cosmology, and the possibility of other life forms in the universe. (Grade or P/NP)

Prerequisites/Corequisites:
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	C	Natural Sciences	Fall 2025	
	L5	Physical and Biological Sciences		
	C	Natural Sciences	Fall 1981	Fall 2025
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B1	Physical Science	Fall 1981	
IGETC:	**Transfer Area**		Effective:	Inactive:
	5A	Physical Sciences	Fall 1981	

CSU Transfer:	Transferable	Effective:	Fall 1981	Inactive:
UC Transfer:	Transferable	Effective:	Fall 1981	Inactive:

CID:

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Evaluate astronomical hypotheses using evidence-based reasoning and the scientific method.
2. Recognize and describe the various astronomical bodies, concentrating on the celestial bodies beyond the Solar System.
3. Summarize the processes which govern the evolution of a star and use this knowledge to predict when and how stars of varying mass will die.

Objectives:
At the conclusion of this course, the student should be able to:
1. Apply the scientific method to astronomy.
2. Identify the regions of the electromagnetic spectrum, discussing how each varies in terms of wavelength, frequency, and energy.
3. Define and cite examples of the properties of waves: reflection, refraction, and diffraction.
4. Describe how continuous, emission, and absorption spectra are created.
5. Discuss the methods of determining the distances to stars and calculate the distance to a star from its observed parallax.
6. Summarize how the mass of a star is derived and list the stellar properties which can be determined if its mass is calculated.
7. Construct a Hertzsprung-Russell diagram and discuss what each region represents in the stellar evolutionary cycle.
8. Summarize the processes which occur as stars of various mass evolve from birth to death,

including their possible core phases: white dwarfs, neutron stars, and black holes.
9. Discuss Einstein's theories of Special and General Relativity.
10. Identify and describe the components of the Interstellar Medium.
11. Describe the structure of the Milky Way Galaxy.
12. Identify and describe the characteristics of the Hubble classification of galaxies.
13. Discuss active galaxies, gravitational lensing, and the possible phenomena which create gamma ray bursts.
14. Discuss the evidence for the Big Bang theory.

Topics and Scope:

I. Overview of the Universe
- A. Science and the scientific method
- B. Celestial bodies in the universe
- C. Distance units and scales

II. Electromagnetic Radiation (EMR)
- A. Electromagnetic spectrum
- B. Wave model of EMR
  1. Wavelength
  2. Frequency
- C. Quantum model of EMR
  1. Photons
  2. Energy
- D. Spectroscopy
  1. Types of Spectra
     a. Continuous spectra
     b. Emission spectra
     c. Absorption spectra
  2. Radiation Laws
  3. The Doppler Effect

III. Stellar Distances
- A. Parallax
- B. Apparent brightness of stars and star clusters
- C. Cepheid variable stars
  1. Period-luminosity relation for Cepheid variable stars
  2. Discovery of other galaxies using the period-luminosity relation

IV. Stellar Masses
- A. Determination of the mass of a star by observing binary star systems
- B. Stars with varying masses and their distribution

V. Nuclear Fusion in Stars
- A. Gravity and gravitational equilibrium
- B. Fusion reactions
- C. Energy production and transport

VI. Stellar Evolution
- A. Stellar spectral sequence
- B. Hertzsprung-Russell diagrams and stellar evolution
  1. Nebulae
  2. Main sequence stars
  3. Giant (Red Giant) stars
  4. Supergiant stars
  5. White dwarf stars
- C. Life cycle of a lower mass star

D. Life cycle of a high mass star
E. Deaths of stars and mass loss
1. Planetary nebulae
2. Supernovae
a. Type II supernovae
b. Type I supernovae

VII. The Core Phase of Stellar Evolution
A. White dwarfs
B. Neutron stars and pulsars
C. Black holes

VIII. Albert Einstein's Theories of Relativity
A. General relativity
B. Special relativity
C. Twin paradox and time dilation

IX. The Interstellar Medium
A. Dust
B. Gas
1. HI Regions
2. HII Regions

X. Star Clusters
A. Open clusters
B. Globular clusters

XI. The Milky Way Galaxy

XII. Other Galaxies
A. Hubble classifications of galaxies
B. Active Galactic Nuclei (AGN'S)
C. Clusters of galaxies
D. Large-scale structure of the universe

XIII. Cosmology
A. Edwin Hubble and his discovery of universal expansion
1. The Hubble Law
2. The Hubble Constant
B. The Big Bang theory
1. Eras of universal history
2. Evidence for the Big Bang theory
C. Dark matter
1. Evidence for dark matter
2. Possible dark matter candidates
D. Gravitational lensing
E. Dark energy and the acceleration of universal expansion

XIV. Life in the Universe
A. Possibility of extraterrestrial life and contact
B. The Drake Equation

Additional topics may include:

I. The Magnitude System
A. Photometry
B. Apparent magnitude
C. Absolute magnitude
D. Distance modulus

II. Extra-Solar Planets

III. Optical Systems
   A. Image formation
   B. Lenses and mirrors
   C. Telescopes types
   D. Cameras

Assignment:

1. Reading from the textbook or instructor prepared materials (averaging one chapter per week, roughly 20 - 30 pages)
2. Homework assignments (3 - 11)
3. Short research paper(s), 500 - 1000 words, using at least two outside sources (0 - 2)
4. In-class exercises (5 - 20)
5. Exams (2 - 4) and/or quizzes (6 - 16), and a final exam

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Homework assignments, research paper	Writing 10 - 30%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework assignments, in-class exercises	Problem solving 10 - 30%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Exams and/or quizzes, and a final exam	Exams 60 - 80%

Other: Includes any assessment tools that do not logically fit into the above categories.

Participation	Other Category 0 - 10%

Representative Textbooks and Materials:
Discovering the Universe. 11th ed. Comins, Neil. Freeman. 2019
Pathways to Astronomy. 6th ed. Schneider, Stephen and Arny, Thomas. McGraw Hill. 2020
The Cosmic Perspective: Stars, Galaxies, and Cosmology. 9th ed. Bennett, Jeffrey. Pearson. 2019
Lecture Tutorials for Introductory Astronomy. 3rd ed. Prather, Ed. Pearson. 2012 (classic)

Stars and Galaxies. 10th ed. Seeds, Michael. Cengage. 2019
Astronomical Tidbits - A Layperson's Guide to Astronomy. Waxman, Gerald. Kendall Hunt. 2017