ANTELOPE VALLEY COLLEGE

Academic Affairs
Course Outline of Record

Academic Affairs Only

- ☐ New Course
  - ☐ Effective Date (for articulation)
- ☒ COR Revision 5/14/09
- ☐ Pre Req/Advisories
- ☐ Other Changes
- ☒ SLOs 4/10/08

COURSE SUBJECT & NUMBER: ASTR 101

COURSE NAME: *Astronomy

COURSE UNITS: 3.0 **COURSE HOURS:** 3.0 hours weekly

COURSE REQUISITES: ***(Follow format of similar courses found in the college catalog.)***
Prerequisite: Completion of MATH 102.

Advisory: Eligibility for College Level Reading, and ENGL 101.

COURSE DESCRIPTION: ***(Write a short paragraph providing an overview of topics covered. Be sure to identify target audience--transfer, major, GE, degree/certificate, etc. If repeatable, state the number of times at end of description as (R#)***.
This course is designed as an introduction into the study of planetary, stellar, galactic and cosmological systems. Emphasis is placed on astronomical observations and the use of physical laws and principles to investigate the properties and dynamics of these systems. Topics include understanding celestial motion as a function of the motion of the Earth and the Moon, the development of modern astronomy, telescopes and imaging technology, the properties of light and atoms, the formation of spectra, stellar structure and evolution, galactic structure and evolution, cosmology, comparative planetology, and search for extraterrestrial life. This course fulfills general education requirements for AVC degree or transfer to CSU/UC. (CSU, UC, AVC)

COURSE OBJECTIVES: ***(Title 5 requires that courses show evidence of critical thinking skills. Use Bloom's taxonomy to formulate concise, performance-based measurable objectives common to all students. Objectives must be closely aligned with course content, assignments, and methods of evaluation)***

Upon completion of course, the successful student will be able to

1. Differentiate scales of time and distance as they relate to planetary, galactic, and cosmological systems.
2. Distinguish motions of the Earth and the Moon that are responsible for the units of time, seasons, lunar phases and tides.
3. Diagram the position of objects on the celestial sphere, lunar and solar eclipses, phases of the moon and tides.
4. Evaluate the contributions of famous astronomers and describe how their discoveries have built the foundation of modern astronomy.
5. Differentiate between refracting and reflecting telescope designs and discuss astronomical imaging techniques.
6. Contrast the appearance and formation of continuous, absorption and emission spectra and explain how astronomers use stellar spectra to determine the physical and chemical properties of stars and galaxies.
7. Calculate the properties of stars from astronomical observations and the use of physical laws.
8. Contrast the various methods used to determine distances on planetary, stellar, galactic and cosmological scales.
9. Examine the arrangement of stars on the Hertzsprung-Russell diagram as it relates to stellar properties and evolution.
10. Contrast the various observational characteristics of binary star systems and how they are used to determine stellar mass.
11. Diagram the stages of stellar birth that celestial objects undergo in becoming main sequence stars.
12. Compare energy generation and stellar structure in low, medium, and high mass stars through different stages of a star's life.
13. Diagram the process of stellar death and formulate the eventual fate of star as a function of stellar mass.
14. Diagram our Milky Way galaxy and contrast the shapes and components of the galaxy with other galaxies.
15. Contrast stellar populations with respect to their physical and chemical characteristics and location in a galaxy.
16. Assess the cosmological implications of Hubble expansion, the evolution of galaxies with redshift and the CMBR.
17. Contrast the properties of terrestrial and jovian planetary types from the perspective of the solar nebula theory.
18. Inventory the members of our solar system and contrast their physical and chemical characteristics.
19. Calculate the probability that extraterrestrial life exists and examine different forms of communication with distant civilizations.

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COURSE CONTENT: ***(Enter course content in terms of specific topics or a specific body of knowledge that each instructor must cover. Put topics in outline form with major and minor headings. Each instructor must cover all material listed below.)***

I. Scale of the cosmos
- A. Hierarchy of cosmic structure
- B. Units of distance
- C. Scientific notation

II. The Sky
- A. Constellations
- B. Asterisms
- C. Apparent magnitude of stars
- D. Star names
- E. Celestial sphere
  - 1. Celestial equator and poles
  - 2. Zenith, nadir, and horizon
  - 3. Meridian

III. Seasons
- A. Perihelion and aphelion
- B. The changing altitude of the noon sun
- C. Date of the four seasons
- D. Topics of Cancer and Capricorn
- E. Arctic and Antarctic circles
- F. Length of daylight throughout the year

IV. Cycles in the sky
- A. Motions of the sun, the moon and the planets
  - 1. Zodiacal constellations
  - 2. Phases of the moon
  - 3. Retrograde motion
- B. Solar and lunar eclipses
- C. Spring and neap tides
- D. Precession

V. History of astronomy
- A. Survey of famous astronomers and their discoveries
- B. Epicycle and deferent
- C. Kepler's laws of planetary motion
- D. Newton's law of gravity

VI. Astronomical observations
- A. Telescope designs
- B. Types of electromagnetic radiation
- C. CCD imaging
- D. Spectrographs
- E. Seeing and adaptive optics

VII. Stellar spectra
- A. Structure of the atom
- B. Formation of spectra
- C. Kirchhoff's laws of radiation
- D. Wien's law and blackbody radiation
- E. Doppler effect

VIII. The Sun
- A. Layers of the Sun
- B. Proton-proton chain
- C. Granulation
- D. Sunspots
- E. Aurora

IX. Properties of stars
- A. Trigonometric parallax
- B. Absolute magnitude and luminosity
- C. Surface temperature
- D. Radius
  - 1. Stefan-Boltzmann law
- E. Chemical composition
- F. Radial velocity and rotation
- G. Stellar Classification
- H. Hertzsprung-Russell diagram

X. Binary stars
- A. Types of binary star systems
- B. Determining stellar mass

XI. Stellar evolution
- A. Stellar birth
  - 1. Interstellar medium
  - 2. Protostars
  - 3. Pre-main sequence stars
- B. Brown dwarfs
- C. Main sequence stars
  - 1. Hydrostatic equilibrium
  - 2. Stellar structure
  - 3. Life expectancy of stars
- D. Stellar clusters
- E. Stellar death
  - 1. Giants and supergiants
  - 2. White dwarfs
  - 3. Neutron stars and pulsars
  - 4. Black holes
  - 5. Planetary nebula and types of supernova

XII. Galaxies
- A. Milky Way galaxy
  - 1. Size and shape
  - 2. Location of the solar system
  - 3. Galactic center
- B. Methods of determining distance on galactic scales
- C. Classification of galaxies
- D. Stellar populations
- E. Active galaxies and quasars
- F. Dark matter
- G. Gravitational lensing

XIII. Cosmology
- A. Cosmological principle
- B. Hubble law
- C. Cosmic microwave background radiation
- D. Big Bang theory

XIV. Our solar system
- A. Solar nebula theory
- B. Planetary types
  - 1. Terrestrial
  - 2. Jovian
- C. Asteroids
- D. Meteoroids, meteors, meteorites
- E. Comets
- F. Kuiper belt and Oort cloud

XV. Life in the universe
- A. Probability of finding extraterrestrial life
- B. Communication with distant civilizations

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TYPICAL HOMEWORK ASSIGNMENTS: (Do not include in-class work, quizzes, or tests)
This information is necessary for all credit courses. Assignments should be closely related to course objectives, content, and methods of evaluation. (See sample of a "Model Outline" in the AP&P Standards & Practices Handbook.) Include a range of assignments (minimum of three) from which faculty may choose when designing their syllabus.

1. ***Describe nature and frequency of typical reading assignments if applicable; note if any are required:***
Students will be expected to read roughly one to two chapters of their textbook on a weekly basis. Reading assignments are required for every student.

2. ***Describe nature and frequency of typical writing assignments if applicable; note if any are required:***
Required: Answering quantitative and qualitative homework questions assigned from the textbook and/or instructor generated on approximately a weekly basis.
Optional: Writing term papers on an instructor chosen topic.

3. ***Describe nature and frequency of typical computational assignments if applicable; note if any are required:***
Required: Several equations will be presented throughout the course of the semester. Computational assignments may be given on weekly homework. Some examples include:

Newton's Law of Gravity – Rational expression
Magnitude-Brightness Relation – logarithmic equation
Drake's equation – probability function
Stefan-Boltzmann Law – expression involving exponents

4. ***Describe other types of homework assignments that students may be asked to complete (oral presentations; special projects; visual/performing arts; etc); note if any are required:***
Optional: Night time observing field trip to locate celestial objects in the night sky.
Optional: Audio-visual presentations of course content.

For categories 1-4 above, list the estimated hours per week it would take a student to complete assignments. *Title 5 (section 55002)* requires that *each unit must be shown to require three hours of work per week by the student either in or out of class.* Homework formula: 3 hours of class work *times* each unit of credit *minus* classroom hours *equals* required homework hours.

Reading Assignments: 3 ***Writing Assignments***: 2

Computational Assignments: 1 ***Other Assignments***: 1

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METHODS OF INSTRUCTION: ***(Methods must be consistent with content and appropriate to objectives; state in terms of what instructor will be doing in order to present course content to students: for example, lecture, demonstration, present audio/visual materials; facilitate group work, etc. Do <u>not</u> list specific instructional equipment.)***

In-class lectures with demonstrations and audiovisual aids when appropriate. Examples include animations of physical phenomenon, computer simulations of celestial motions, digital images taken from astronomical telescopes, and videos. Audiovisual aids may also come in the form of diagrams and graphs helping to visual and organize celestial behavior.

METHODS OF EVALUATION: ***(These must be clearly related to course objectives and reflect course content and assignments in order to comply with Title 5 requirements. <u>Describe what instructor will be looking for when evaluating various assignments and tests in order to determine whether students have met course objectives.</u> Grades must be based on demonstrated proficiency in subject matter and determined, where appropriate, by essays, objective and essay tests, research papers or projects, problem solving exercises, or skills' demonstrations.)***

Homework writing assignments both quantitative and qualitative in nature, multiple-choice quizzes, and periodic multiple-choice and essay examinations will be used to evaluate student understand in the following areas:

How to organize and compare scales of time and distance for planetary, galactic and cosmological systems (Objectives 1,8, 19).
How to distinguish motions of the Earth and Moon that are responsible for daily, monthly, seasonal and yearly effects (Objectives 2, 3, 4).
How to diagram the physical properties of stars as they relate to stellar structure and evolution and contrast those with the Sun (Objectives 6, 7, 9, 10, 11, 12, 13).
How to diagram the physical properties and appearance of galaxies as they relate to galactic structure and evolution and contrast those with the Milky Way (Objectives 6, 14, 15, 16).
How to inventory the members of our solar system and compare their physical characteristics as they relate to the terrestrial and jovian planetary archetypes (Objectives 17, 18, 19).
How to utilize astronomical observations and apply physical laws and principles to analyze the physical properties and dynamics of planets, stars and galaxies. (Objectives 5, 6, 7, 8, 10, 19)

Additionally, in-class multiple choice 'clicker' style questions may be used to gauge student understanding and comprehension of material in real-time. Grades assigned for such activities are left to the instructor's discretion.

Optionally, written term papers or audio-visual presentations are evaluated to assess a student's understanding of the scientific process of astronomical observations.

Suggested Texts or Other Instructional Materials
(List several when possible; include title, author, publisher, date, and latest edition. If older than five years, provide brief rationale.)
Horizons: Exploring the Universe by Seeds, Brooks/Cole, 2008, 11th edition
The Cosmic Perspective by Bennett, Donahue, Schneider, and Voit, Pearson Addison-Wesley, 2008, 5th edition
Pathways to Astronomy by Schneider & Arny, McGraw-Hill, 2007, 1st edition
In Quest of the Universe by Kuhn & Koupelis, Jones and Bartlett, 2007, 5th edition
Discovering the Universe by Comins & Kaufmann, W.H. Freeman, 2008, 8th edition