

San Bernardino Valley College
Curriculum Approved: Spring, 2000

I. CATALOG DESCRIPTION

- A. Division: Science
Department: Astronomy
Course ID: ASTRON 123
Course Title: Introduction to Astronomy
Units: 4
Lecture: 3 hr
Laboratory: 3 hr
Prerequisites: none
Departmental Advisory: Elementary math skills as covered in a course such as High School Algebra or MATH 090

- B. Course Description:
An introduction to astronomy, the ultimate adventure. Our very big universe can be described by a small set of knowable rules through a logical method called science, where the excitement of an evolving and sometimes violent universe of stars and galaxies is explored. Topics include the night sky, motions of the Sun, the Moon, and the planets, light, properties and life-cycles of stars with a detailed look at our Sun, galaxies, and the origin of the universe. A series of laboratories supplement and enhance topics discussed in lecture.

Schedule Description:

An introduction to astronomy, the ultimate adventure. Our very big universe can be described by a small set of knowable rules through a logical method called science, where the excitement of an evolving and sometimes violent universe of stars and galaxies is explored. Topics include the night sky, the solar system, galaxies, and the origin of the universe. A series of laboratories supplement and enhance topics discussed in lecture.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon successful completion of the course, the student should be able to do the following:

- A. Read and critically evaluate basic scientific literature involving astronomical concepts,
- B. Apply basic scientific principles to new situations,
- C. Identify basic astronomical features in the sky
- D. Recognize and use celestial coordinate systems
- E. Apply the basic physical laws of motion, gravitational, electromagnetic, and nuclear forces.
- F. Explain how light conveys information about the universe.
- G. Explain the principles and operation of various astronomical instruments.
- H. Identify the structure and life cycle of stars,
- I. Describe the properties of various types of galaxies,
- J. Describe the Big Bang and the fate of the universe,
- K. Identify and describe the planets and other members of the solar system.
- L. Analyze the motion of moons and planets.
- M. Compare planetary properties (comparative planetology).
- N. Examine the probability and possibility of extraterrestrial life.
- O. Construct models.
- P. Observe and describe planets, moons, stars, and galaxies.

IV. CONTENT:

A. Exploring the Sky

- a. scale of the universe
- b. the sky
- c. cycles of the sky
- d. origins of modern astronomy
- e. Newton, Einstein and gravity
- f. astronomical instruments
 - properties of light
 - telescopes
 - spectrometers
 - photometers
 - radio telescopes
 - beyond the visible spectrum

typical experiments: optical systems: telescopes, cameras
quantitative techniques: properties of angles, celestial positions
magnitude scales
telescope observations

B. The Stars

- a. atoms and starlight
- b. the sun
- c. the properties of stars
- d. the formation of stars
- e. the structure of stars
- f. the death of stars
 - neutron stars
 - white dwarfs
 - novae, supernovae
 - black holes

typical experiments: black body radiation
stellar observations
atomic spectra
Hertzsprung-Russell Diagram
telescope observations

C. The Universe of Galaxies

- a. the Milky Way
- b. galaxies
- c. galaxies with active nuclei
- d. cosmology
 - structure of the universe
 - the Big Bang
 - the fate of the universe
- e. life on other worlds

typical experiments: study of a typical galaxy such as the Andromeda
expansion of the universe-red shifts
telescope observations

D. Planets and the Solar System

- a. planet earth
- b. a general survey of the planets of the solar system
- c. meteors, asteroids, comets
- d. origin of the solar system

typical experiments: Kepler's laws
modeling the earth-moon system
phases of the moon
lunar features

*telescope observations***V. METHODS OF INSTRUCTION:**

Instructors will include some or all of the following instructional components:

- A. Classroom lecture. May be accompanied by activities such as demonstrations, video, film, and computer simulations, and planetarium presentations.
- B. Specific reading assignments to reinforce and extend classroom presentations.
- C. Demonstration experiments evoking discussion and problem solving.
- D. Computer aided instruction.
- E. Written assignments involving the analysis and understanding of astronomical phenomena from basic physical theory.
- F. Students will utilize critical thinking in performance of specific problem solving strategies.
- G. Laboratory experimentation. Students work toward specific goals of observation and analysis.
- H. Students write and summarize their laboratory observations. Writing includes background, data analysis, and documentation of principles and apparatus.
- I. Written assignments involving the solution of problems illustrative of various physical situations.
- J. Other written assignments such as planetarium show reviews, discussion of night sky observations, description of star party activities, summaries of radio and television broadcasts, and other astronomy related activities. Activities as designed to engage the student in potentially life-long astronomy pastimes.
- K. Other written assignments such as library research including analysis of current popular scientific literature.

VI. TYPICAL ASSIGNMENTS:

- A. Chapter 5 – Astronomical Tools - read entire chapter
- B. Write answers to questions at the end of the chapter
Typical End of Chapter Questions:
 - Why do optical astronomers sometimes put their telescopes on top of mountains, while radio astronomers put their telescopes in valleys?
 - What purpose do the colors in a false-color image serve?
 - What might we detect with an X-ray telescope that we could not detect with an infrared telescope?
- C. Master terminology: electromagnetic radiation, wavelength, photon, nanometer, angstrom, focal length, primary lens or mirror, objective lens or mirror, eyepiece, chromatic aberration, Newtonian telescope, prime focus, atmospheric window
- D. Perform an internet search on the term Hertzsprung-Russell Diagram. Identify at least three web sites and (i) discuss the content and (ii) rate the value of the site on a scale of 1 to 5.
- E. Describe and discuss the phases of the moon that you observe over the period of one month.

VII. EVALUATION:**A. Methods of Evaluation:**

- Grading may be comparative (scaling, curve) or based on an absolute standard.
- Questions are designed to evaluate student comprehension of the learning goals enumerated in item IV above. Students will be asked to identify basic principles, recognize and apply common terminology, and apply fundamental knowledge to real world situations. Students will display an understanding of basic astronomical principles
- Methods of evaluation will vary with the instructor, and may include some or all of the following components.

- Objective tests which may include true-false, multiple choice, and matching items.
- Subjective tests which may include completion items and essay questions.
- Laboratory performance
- Problem solutions
- Projects
- Home experiments
- Written assignments

B. Frequency of evaluation:

- There are typically three to five exams during the semester.
- Other, more frequent evaluation techniques, such as quizzes, may be utilized.

C. Typical exam questions:

- Which of the following features must an atomic model have *to explain* the way alpha-particles pass through a thin, gold foil? (multiple choice)
 - a. an atom must contain electrons
 - b. an atom must have a small, positively-charged, massive nucleus
 - c. electrons must have a negative charge
 - d. an atom must have definite energy levels
 - e. all of these
- Write the equation describing the law of gravitation. Draw a diagram labeled with the appropriate symbols used in your equation. Describe in words the law of gravitation.
- The observed changes in the size of the Martian polar "ice" caps led astronomers to conclude that Mars (multiple choice)
 - a. went through seasons.
 - b. rotated on its axis.
 - c. had life on its surface.
 - d. had a weak magnetic field.
- Describe two astronomical tests that confirm Einstein's theory of relativity.
- What evidence do we have that the entire planetary system was subjected to heavy bombardment by asteroid-size objects.

VIII. TYPICAL TEXT(S):

Horizons, M. Seeds, Brooks/Cole, Pacific Grove, CA 2000

Discovering the Universe, N. Comins & W. Kaufmann, W.H. Freeman, New York, 2000

Explorations, T. Arny, McGraw-Hill, 2000

Laboratory handouts and worksheets

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

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San Bernardino Valley College
Last updated: 1/2000

Step 3, Form A

**Content Review Form
ADVISORY COURSE**

Target Course: **Astronomy 123**

Prerequisite Course: Math 090

Instructions:

1. List exit competencies (skills) from Prerequisite Course. These skills are listed in the 'Student Outcomes' section of the Course Outline ("upon completion of the course, the student should be able to...")
2. Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.
3. Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:
1 =Critical 2=Very Helpful 3=Desirable

Skills Analysis

<i>Entry Skills in Target Course</i>	<i>Exit Skills Provided by Prerequisite Course</i>	<i>Degree of Importance (Rate 1 - 3)</i>
A. Recognize and identify the properties of Addition and Multiplication for real numbers	X	2
B. Solve linear equations and inequalities	X	3
C. Analyze an application problem and formulate and express their findings in an appropriate mathematical equation	X	2
D. Know the vocabulary for polynomials and perform the 4 operations (add, subtract, multiply and divide) for polynomials		
F. Determine the base and exponent in an exponential expression and use combinations of rules to simplify the exponential expression (powers of ten)	X	3
G. Factor polynomials		
H. Solve higher-degree equations by factoring		
I. Perform arithmetic operations with rational expressions to include simplification, addition, subtraction, multiplication and division	X	2
J. Solve equations containing rational expressions; determine values for which a rational expression is undefined.	X	3
K. Graph a line.	X	2