TAMALPAIS UNION HIGH SCHOOL DISTRICT
Larkspur, California

Course of Study

Astronomy 1-2

I. INTRODUCTION

This course is intended to offer an additional physical science elective to the science curriculum at TUHSD. Students in astronomy will utilize basic concepts of chemistry, physics, and earth science, as applied to the study of stars, galaxies, and history of the universe. The course will be divided into two semesters. The first will focus on stars and the universe, including stellar evolution, types of stars, galaxies, and cosmology. The second semester will focus on the solar system, including lunar phases, astronomical tools, the sun, and the solar system. This Astronomy course, a physical science elective, will be intended for upper grade levels after successful completion of Integrated Science 1-4. The option of concurrent enrollment for students enrolled in I.S 3-4 available with teacher recommendation. The course is intended to appeal to students who are interested in the physical sciences but who may not pursue chemistry or physics as an elective. It may also be directed at students who have already completed the other two physical science options.

This course addresses the following Tam 21st Century goals:

1. Student Success
    a) Set and maintain world-class academic standards and the highest expectation for student social behavior and personal performance: assess and communicate District performance in meeting those standards.
    b) Provide opportunities for, and encourage students to, demonstrate individual and collective responsibility, creativity, productivity, and initiative through class, school, and community projects and experiences.
2. Instruction
    a) Support innovative instruction, programs, and organizational change.
    b) Provide opportunities for student and parental choice of instructional programs, within and among district schools.

This course addresses the following Student Learning Outcomes:

* Learning Outcome 2: Read and analyze material in a variety of disciplines.
* Learning Outcome 3: Use technology as a tool to access information, and analyze and solve problems, and communicate ideas.
* Learning Outcome 5: Apply mathematical knowledge and skills to analyze and solve problems.

* Learning Outcome 6: Demonstrate scientific literacy.

This course is designed to help students attain the state Earth Science ("Earth's Place in the Universe") Content Standards.

II. STUDENT LEARNING OUTCOMES

A. Students will:

1) describe the scale of the cosmos, solar system, galaxy, universe by comparison to common earthly objects
2) calculate the scale of astronomical objects using scientific notation, using appropriate units (light years etc.)
3) understand the basis for division of the sky by constellation
4) calculate magnitudes of stars in order to understand classification
5) explain the seasons, solar and lunar cycles, solar and lunar eclipses, and planetary orbits, including the moon's influence on tidal forces.
6) understand the roots of astronomy, including the studies of Aristotle, Copernicus, Galileo, Brahe, and Kepler.
7) define "unifying theory" and show how scientists build concepts to explain and develop unifying theories.
8) analyze data in order to understand how the properties of light are critical for astronomers to understand the universe.
9) analyze information gathered by telescopes and other technologies.
10) apply concepts of modern physics, especially the interaction of light and matter, to specific topics in astronomy, such as the sky.
11) describe star makeup in detail.
12) apply the interaction of light and matter to learn about astronomy.
13) apply physical concepts to learn how stars form, live, die, and what remains when they're gone.
14) describe the structure and origin of the milky way galaxy, including mass, shape, content, and age.
15) understand that active galaxies emit many different wavelengths of radiation.
16) describe the processes that led to the origin of the solar system.
17) compare and contrast the planets and moons within our solar system.
18) describe the role that small bodies (asteroids, etc) play in our solar system.
19) explain the role of living beings in the origin and evolution of the universe.

B. Students will cover the following state *Astronomy* Content Standards:

1) Astronomy and planetary exploration reveal the solar system's structure, scale, and change over time. As a basis for understanding this concept:
   - Students know how the differences and similarities among the sun, the terrestrial planets, and the gas planets may have been established during the formation of the solar system.

- Students know the evidence from Earth and moon rocks indicates that the solar system was formed from a nebular cloud of dust and gas approximately 4.6 billion years ago.
- Students know the evidence from geological studies of Earth and other planets suggest that the early Earth was very different from Earth today.
- Students know the evidence indicating that the planets are much closer to Earth than the stars are.
- Students know the Sun is a typical star and is powered by nuclear reactions, primarily the fusion of hydrogen to form helium.
- Students know the evidence for the dramatic effects that asteroid impacts have had in shaping the surface of planets and their moons and in mass extinctions of life on Earth.
- Students know the evidence for the existence of planets orbiting other stars.

2) Earth-based and space-based astronomy reveal the structure, scale, and changes in stars, galaxies, and the universe over time. As a basis for understanding this concept:
   - Students know the solar system is located in an outer edge of the disc-shaped Milky Way galaxy, which spans 100,000 light years.
   - Students know galaxies are made of billions of stars and comprise most of the visible mass of the universe.
   - Students know the evidence indicating that all elements with an atomic number greater than that of lithium have been formed by nuclear fusion in stars.
   - Students know that stars differ in their life cycles and that visual, radio, and X-ray telescopes may be used to collect data that reveal those differences.
   - Students know accelerators boost subatomic particles to energy levels that simulate conditions in the stars and in the early history of the universe before stars formed.
   - Students know the evidence indicating that the color, brightness, and evolution of a star are determined by a balance between gravitational collapse and nuclear fusion.
   - Students know how the red-shift from distant galaxies and the cosmic background radiation provide evidence for the "big bang" model that suggests that the universe has been expanding for 10 to 20 billion years.

C. Students will cover the content specified in II.B (above) as included on the California Standards Test (CST) in Earth Science.

III. ASSESSMENT

A. Student Assessment

- traditional tests developed by teacher
- teacher evaluation of lab reports
- attendance at a required number of field activities
- teacher evaluation of research project and presentations

Students will be given the grading criteria and course expectations, preferably in writing, at the beginning of the course.

B. Course Assessment

The course assessment will be based on two common components:

a. Comprehensive field study of a portion of the sky
b. Final exam to test knowledge and understanding of concepts

IV. METHODS AND MATERIALS

A. Methods

A variety of instructional methods may be used to further the understanding of students including, but not limited to, computer based labs, research projects, presentations, discussions, readings, demonstrations, and lectures.

B. Materials

The primary text for the class:

Seeds, Foundations of Astronomy (Thomson, Brooks, Cole)

Supplementary instructional materials:

Walker, Bill, Redshift (Thomson, Brooks, Cole)

C. Technology

Students will use computer-based astronomy lab software that take them through "real" astronomical observations. They will also have access to telescopes and will use computers to access information and to generate presentations and projects and for research purposes.

D. School to Career Goals

Utilize guest speakers and career investigation while developing scientific skills useful in a workplace environment.

E. Suggested Instructional Time Allocation

1. Instruction Strategies

a.	Laboratory activities	40%
b.	Lecture/discussion/guest speakers	30%
c.	Group activities	10%
d.	Videos	10%
e.	Projects	10%

2. Curricular Topics

a.	The Sky	7 weeks
b.	The Stars	7 weeks
c.	The Universe	7 weeks
d.	The Solar System	7 weeks
e.	Life in the Universe	2 weeks

V. GENERAL INFORMATION

A. Prerequisites

Astronomy is a 10-credit physical science course open to students who have successfully completed Integrated Science 1-4 or who are currently enrolled in Integrated Science 3-4 (with teacher recommendation).

B. Requirements Met

This course may be used as elective credit towards graduation but does not meet any specific graduation requirement. It meets the UC "g" elective requirement.

.

Board Adopted: 3/28/06