



Introduction to Astronomy

Course Summary:

In this course the student will explore a broad range of astronomy topics, including the planetary system, stars, galaxies, and the universe. The student will also apply the scientific method and examine the evolution of scientific ideas. By the end of the course, the student will be able to

- Assess the nature, scope, and evolution of the Universe
- Apply fundamental concepts underlying astronomy
- Evaluate the evolution of scientific ideas in astronomy
- Analyze data to determine patterns, relationships, perspectives, and credibility

Course Outline

1. Earth's Place in the Universe (L)

- Relate Earth's size and location to other objects in the solar system and within the universe
- Describe how the celestial sphere and constellations are used to locate objects in the sky
- Account for the apparent motion of the sun and stars and the changing appearance of the moon
- Explain how Earth's tilt causes the seasons
- Explain the cause of retrograde motion of planets and how distances in space are measured

2. The History of Astronomy (L)

- Explain how ancient civilizations used astronomy to determine direction and keep time
- Identify ancient Greek beliefs about the solar system
- Compare and contrast the geocentric and heliocentric models of the solar system
- Identify the main contributions of Copernicus, Brahe, Kepler, and Galileo to the field of astronomy
- Analyze planetary motion using Kepler's laws of planetary motion

3. Scientific Methods in Astronomy (L)

- Distinguish between observations, experiments, hypotheses, and theories
- Describe how scientists use scientific methods of observation and testing to understand the universe
- Identify possible effects from measurement errors
- Recognize the difference between scientific theory and nonscience

4. Motion, Energy, and Gravity (L)

- Relate Newton's laws to Kepler's laws of planetary motion
- Apply Newton's laws of motion to planetary motion
- Understand that there is a gravitational force between any two objects with mass
- Relate conservation laws to motion and energy in space
- Describe how gravitational forces between the moon, the sun, and Earth cause tides

5. **Light, Matter, and Telescopes (L)**

- Relate the properties of electromagnetic radiation to the behavior of waves and particles, including how it is studied
- Identify properties of matter in terms of its atoms, elements, and phases
- Explain how to determine an object's temperature and relative motion
- Describe how spectra are used to determine the chemical composition of stars and galaxies
- Explain how telescopes and other detector technologies are used to study light

6. **Our Solar System (L)**

- Describe patterns of motion in the solar system including exceptions
- List basic differences between terrestrial and Jovian planets
- Summarize the theory of the formation of the solar system
- Differentiate the formation of the terrestrial and Jovian planets
- Explain how radioactive dating is used to determine the age of the solar system

7. **Terrestrial Surfaces and Interiors (L)**

- Describe the interior of terrestrial planets, including heat sources and transfers
- Identify the major geological processes that change the surface of terrestrial planets
- Compare and contrast the surface of the terrestrial planets

8. **Terrestrial Atmospheres (L)**

- Identify factors that cause planets to gain or lose atmospheres
- Describe the greenhouse effect on the terrestrial planets
- Compare and contrast the atmosphere on the terrestrial planets

9. **Jovian Planets (L)**

- Compare and contrast the interior structures of Jovian planets
- Describe similarities and differences in atmospheres of Jovian planets
- Describe the geology of the moons of the Jovian planets
- Identify the origins and compositions of the ring systems

10. **Smaller Objects in the Solar System (L)**

- Summarize orbital and physical properties of asteroids
- Describe the composition and structure of comets
- Explain how meteorites are related to asteroids and comets
- Identify dwarf planets
- Explain the collisions of small objects with planets

11. **Exosolar Planets (L)**

- Explain the various methods used to detect exoplanets
- Describe the characteristics of exosolar planets
- Account for the discovery of hot Jupiter-like planets
- Identify missions that discovered exosolar planets

12. **A Star Is Born (L)**

- Summarize the formation of main-sequence stars
- Explain how stellar distances are measured
- Describe how the brightness of stars is determined
- Relate a star's temperature to its color
- Use an H-R diagram to identify stellar properties

13. **It's a Star's Life (L)**

- Identify the characteristics for determining the life of a star
- Describe the evolution of low-mass stars
- Describe the evolution of high-mass stars
- Identify the end products of a star's life

14. **The Milky Way (L)**

- Analyze the early understanding of the Milky Way

- Explain the appearance and structures within the Milky Way galaxy
- Explain the components of interstellar medium
- Identify the structures at the center of the galaxy

15. Galaxies (L)

- Classify different types of galaxies
- Explain how to use the distance ladder to measure galactic distances
- Explain the discovery of the expanding universe
- Explain how galaxies are formed

16. The Big Bang Theory (L)

- Describe the evidence for the big bang theory

17. Dark Matter and Energy (L)

- Explain the nature of dark matter and evidence for its existence
- Identify how the amount of dark matter is measured
- Describe the nature of dark energy and how its existence has been confirmed
- Identify the three possible fates of the universe

18. Introductory Astronomy Final Exam (L)