

ASTR 100 Introductory Astronomy: A Study of the Solar System and Beyond

Course Description

The course addresses the study of the physical nature of objects in the universe and the methods used by astronomers to understand them. It also provides an overview of the techniques used to acquire the knowledge of how we know what we know about the universe. Topics include history, basic laws of nature, the solar system, stars, nebulae, galaxies and cosmology. (3 credit hours)

Course Objectives

This course uses adapted-lectures, textbook readings, a variety of in-class activities, multimedia presentations, and numerical and conceptual exercises.

By the end of the course, students will be able to:

- **identify** and **recognize** key terms, theories, and laws in nature and in Astronomy,
- **describe** the *unique aspects* of *Astronomy*,
- **explain** the significance of values of using different units (meters, grams, seconds) along with the prefixes used with these units (i.e. nano-, micro-, milli-, centi-, kilo-, mega-, giga-) as they pertain to Astronomy,
- **use** powers of ten to describe how they relate to sizes and distances expressed in Astronomy,
- **define** what constellations are and describe their nature and value,
- **explain** how stars are named and their brightness denoted,
- **relate** the true motions of Earth to the changing appearance of the day and night skies to such phenomena as diurnal motion,
- **relate** the true motions of Earth to the changing appearance of the day and night skies to such phenomena as seasonal cycles of the Sun, monthly cycles of the Moon and the planets,
- **list** the *five true motions* of Earth and describe the consequences of each motion, that is, the apparent motions which are observed in the sky,
- **explain** why there are seasonal changes on Earth,
- **describe** the main cause of seasons on Earth,
- **identify** and explain the general motions of the planets in the sky,
- **describe** how early cosmological models explained planetary motion,
- **state** Kepler's Laws of planetary motion,
- **list** Galileo's observations and describe their impact on the heliocentric and geocentric cosmologies,
- **state** the results of Galileo's experiments and how they impact the physical phenomena are expressed,
- **develop** problem solving techniques using Newton's Laws and the Universal Law of Gravitation,
- **state** the two natures of light and examples of each,
- **list** the properties of light,
- **identify** and **list** the components and types of telescopes,

- **state** how spectroscopic analysis provides information about the astronomical objects,
- **define** the physical meaning of temperature,
- **describe** how motion and distance affect light emitted by astronomical objects,
- **draw** and discuss the structure of the atom in terms of the Rutherford and Bohr models,
- **list** the evidential clues as to the origin of our Solar System,
- **define** comparative Planetology for the objects in our Solar System,
- **compare** and **contrast** general physical and chemical characteristics of terrestrial and jovian planets,
- **classify** the planets in our Solar System given specific chemical and physical criteria,
- **describe** the general physical and chemical characteristics and the most probable origin of asteroids and comets,
- **describe** the significance and possible "impact" these types of objects might have on life here on Earth,
- **what** are the Nemesis Theory and the Tunguska Event,
- **list** the general physical and chemical characteristics of the Sun,
- **describe** the possible origin of the Sun,
- **state** the most likely energy source that accounts for the energy produced inside the Sun,
- **describe** the phenomena in the Sun's atmosphere that may impact Earth,
- **list** the general physical and chemical characteristics of stars,
- **state** the physical laws that control the general physical and chemical characteristics stars,
- **describe** the techniques used by astronomers to obtain information about stars,
- **discuss** stellar evolution in the stars,
- **discuss** stellar evolution in terms of the Sun and how it may impact life on Earth,
- **state** the general physical and chemical characteristics of the Milky Way,
- **state** the general physical and chemical characteristics of other galactic systems,
- **describe** current ideas in cosmology,
- **discuss** whether the universe is infinite or bounded in space and time,
- **discuss** the observational evidence that supports current theories about the nature of the universe,
- **discuss** the kinds of evidence that are used to support ideas about life on other planets

Course Rationale

Astronomy is a traditional realm for the Natural Science. Astronomy is really unique among the Natural Sciences. However, it shares with the other Natural Sciences in the ability to construct precise physical laws and theories which permit accurate predictions and tests. These physical laws and theories form the foundation for modern technology. The most progressive societies today have advanced due to their ability to develop and apply scientific principles in such diverse areas as agriculture, medicine, manufacturing, and the military. It is imperative that professionals in such a society understand the similarities and differences between science and technology and the value of each. Advances in science and technology are inextricably linked and are central to the advance of civilization in general and to our country in particular. Democratic citizens must understand this link to make value judgments and decisions related to science and technology.

Course Content, Format and Bibliography

Content

History of Astronomy

Motions in the Sky

Early Cosmological Models

Laws of Nature

Laws of Light and Astronomical Instruments

The Solar System

Properties of the Sun and Stars

Stellar Evolution

The Milky Way

Other Stellar Systems (Galaxies)

Cosmology

Format

The course format consists of adapted lectures, class discussions, and in-class activities. Students will have the opportunity to engage each other and the instructor concerning astronomical phenomena.

Bibliography

Kaufmann, *Discovering the Universe*, Freeman.

Kuhn, *In Quest of the Universe*, West Publishing Company.

Comins, *Discovering the essential Universe*, Fifth Edition.

Seeds and Backman, *Universe*, Brooks/Cole Cengage Learning