ASTRONOMY

The minor/concentration in Astronomy helps prepare students for entry into the competitive science, technology, engineering, and mathematics (STEM) workplace. Students gain exposure to the principles of astronomy, physics, and mathematics. They learn to think critically and evaluate, interpret, and solve problems related to astronomical, as well as other technical and general scientific topics.

Minor or Integrative Studies Concentration Requirements

A minor or concentration consists of 12 credit hours of upper-level courses from the following:

Gateway courses: Three (3) to six (6) credit hours from 300 level ASTR or PHYS 305.

Advanced courses: Six (6) to nine (9) credit hours from 400 level ASTR including up to 3 credit hours in independent study or directed research, ASTR 498 and/or ASTR 499 may be applied to the completion of the minor or concentration.

ASTR 130 Introduction to Astronomy 3 Credit Hours
A one-term introduction for those interested in learning about the present state of knowledge of the Universe, its origin, evolution, organization, and ultimate fate. Exciting new discoveries concerning extrasolar planets, star birth, supermassive black holes, dark matter/dark energy, and cosmology are discussed. Two years of high school math or its equivalent recommended.

ASTR 131 Introductory Astronomy Lab 1 Credit Hour
An introduction to some of the important observational techniques and analytical methods used by astronomers. Ground-based and satellite data will be used to reveal physical and chemical properties of the moon, planets, stars, and the Milky Way. Outdoor exercises involving telescopic observation of the sun, variable stars, nebulae, and external galaxies are also included. Constellation identification will be taught using off-campus planetarium facilities.
Prerequisite(s): ASTR 130* or PHYS 130

ASTR 133 Search for Life in Universe 3 Credit Hours
Full Title: The Search for Life in the Universe A one-semester course on the scientific search for life throughout the Universe. The range of environments hospitable for life form an organizing principle by which to examine several aspects of modern Astronomy including, but not limited to: habitats in the Solar System; physical constraints on life and unusual chemistry; the Search for Extraterrestrial Intelligence and the Fermi Paradox. (F)

ASTR 301 Astrophysical Concepts 3 Credit Hours
A one-semester course introducing the Physical concepts used in Modern Astrophysics, with an emphasis on the application of these ideas to Astrophysical objects. The course familiarizes the student with the Astronomical concepts and vocabulary used in other Astronomy courses at the 300-level and beyond. The course begins with an overview of Astronomical objects and terminology, before introducing conservation laws in Physics and their applications in Astronomy. Newtonian mechanics and gravity are then introduced and applied to various self-gravitating systems and scenarios. Electromagnetism, Quantum Mechanics and a small amount of Statistical Physics are covered at sufficient detail to understand the behavior of electromagnetic radiation and thermal emission. Special and General relativity are introduced from the point of view of understanding the behaviors of certain exotic objects in Astronomy. Common statistical distributions used in upper-level Astronomy courses are also introduced with an emphasis on application.
Prerequisite(s): (MATH 114 or MATH 116) and (PHYS 126 or PHYS 151)
Restriction(s):
Can enroll if Level is Graduate or Undergraduate
Can enroll if College is Engineering and Computer Science or Education, Health, and Human Services or Business or Arts, Sciences, and Letters

ASTR 330 The Cosmic Distance Scale 3 Credit Hours
An exploration of the cosmic distance ladder focusing on the systems and techniques that astronomers use in establishing the distances to celestial objects. Direct measures using radar ranging and trigonometric parallax will be discussed for objects in the solar system and for stars within about 3000 light-years of the Sun, respectively. For more remote systems in or just outside the Milky Way, methods based spectroscopic parallax and the period-luminosity relation for various types of variable stars will be introduced. For the extra-galactic objects, use of the Hubble relation and the light curves of Type Ia supernovae will be made to assess the distances. At each rung of the ladder, emphasis will be placed on the astrophysical principles and processes underlying the methodology being applied. 3 hours lecture
Prerequisite(s): (MATH 113 or MATH 115) and (PHYS 126 or PHYS 151)

ASTR 361 Observational Techniques 3 Credit Hours
This course is designed to provide students with an understanding of some of the basic observational techniques use by astronomers in gathering and analyzing data from celestial objects. Practical experience in acquiring, displaying, and interpreting optical and radio observations using the University's 0.4-m telescope and 2.3-m radio dish will be emphasized. Topics will include astronomical coordinate system and timekeeping, telescope optics, the design and use of CCD detectors, fundamentals of multi-color photometry, an introduction to astronomical spectroscopy, and radio measurements of the Sun and interstellar hydrogen clouds at 21-cm wavelengths. (2 hours lecture, 3 hours laboratory)
Prerequisite(s): (ASTR 130 or PHYS 130) and (PHYS 126 or PHYS 151)

ASTR 390 Topics in Astronomy 3 Credit Hours
A lecture in a topic of current interest in astronomy. Topics vary and are announced in the current Schedule of Classes. Three hours lecture.
Prerequisite(s): ASTR 130 or PHYS 130

ASTR 390A Topics in Astronomy 3 Credit Hours
Topic: Dark Matter, Dark Energy, Dark Future? An Introduction to 21st Century Cosmology. Modern cosmology, buttressed by increasingly precise observational data provided by space missions like HST, COBE, and WMAP, teaches that the universe is composed primarily of matter we cannot see nor properly characterize, the so-called 'dark matter,' and of energy whose source is unknown and may defy knowing, the ubiquitous 'dark energy.' This course will attempt to elucidate what we currently understand about the composition, structure and evolution of the universe based on general relativistic theory and astronomical observations of remote galaxies using both ground- and space-based technologies. Special attention will be given to the means by which important cosmological parameters that determine the structure of the universe, like the critical density, the Hubble parameter, and the curvature and cosmological constants, are established. If time permits, additional consideration will be given to the array of planned future space missions devoted to cosmology-related subjects.
Prerequisite(s): PHYS 305

ASTR 421 Stellar Astrophysics 3 Credit Hours
An application of important physical principles to stars and star clusters. Topics will include gravitational collapse and star formation, radiative transfer and stellar atmospheres, nucleosynthesis and the structure of normal stars, degeneracy and the endpoints of stellar evolution, and general relativistic effects in the vicinity of black holes. 3 hour lecture.
Prerequisite(s): (PHYS 305 or ASTR 301 or ASTR 330) and (MATH 205 or MATH 215)

ASTR 445 Galaxies and Cosmology 3 Credit Hours
A course devoted to our current understanding of the composition, structure, and evolution of the universe based on general relativistic theory and astronomical observations of remote galaxies using both ground-and space-based technologies. Topics include observational characteristics, classification, kinematics and evolution of galaxies, quasars and active galactic nuclei, the cosmic microwave background radiation, concepts of general relativity, single-and multi-component models of the universe, dark matter and dark energy, and the orgin of the universe (the big bang, inflation and the creation of the first elements). Three hous lecture. (AY)
Prerequisite(s): (PHYS 305 or ASTR 301 or ASTR 330) and (MATH 114 or MATH 116)

ASTR 498 Directed Studies in Astronomy 1 to 3 Credit Hours
Special topics in astronomy chosen by mutual agreement between the student and the instructor. Course may be repeated for credit. (F, W, S)

ASTR 499 Research in Astronomy 1 to 3 Credit Hours
Observational/experimental studies in astronomy selected by agreement between the student and the instructor. Four to twelve hours laboratory/independent study. May be repeated for credit. (F, W, S)

*An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally