ASTRONOMY (ASTRON)

ASTRON 100 — SURVEY OF ASTRONOMY
4 credits.

Modern exploration of the solar system; our galaxy of stars, gas and dust; how stars are born, age and die; unusual objects such as exploding stars, neutron stars, black holes, and exploding galaxies; other galaxies and groups of galaxies; current ideas about the large-scale structure and evolution of the universe; optional telescope viewing sessions. Open to all Undergrads. Stds may not receive cr for both ASTRON 100 either ASTRON 103 or 104. Not open to stdts who meet prereq for ASTRON 200

Requisites: Completion of QR-A.

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Optional (%)
Repeatable for Credit: No
Last Taught: Spring 2006

ASTRON 103 — THE EVOLVING UNIVERSE: STARS, GALAXIES, AND COSMOLOGY
3 credits.

The universe is vast and ever-changing. Includes lifecycles of stars; supernovae and creation of elements; white dwarfs, pulsars and black holes; the Milky Way and galaxies; distances of stars and galaxies; quasars; expansion of universe; open and closed universes; the big bang. Open to all Undergrads. Stds may not receive cr for both ASTRON 100 103. Not open to stdts who meet prereq for ASTRON 200

Requisites: Completion of QR-A.

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Optional (%)
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 104 — OUR EXPLORATION OF THE SOLAR SYSTEM
3 credits.

Humanity is linked to the solar system in countless ways. Includes the sky and celestial motions; ancient astronomy; the Copernican revolution; gravity, orbits, and interplanetary travel; formation of solar system; survey of sun, planets and moons; asteroids, meteors and comets; origin of life. Open to all Undergrads. Stds may not receive cr for both ASTRON 100 104

Requisites: Completion of QR-A.

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Optional (%)
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 113 — HANDS ON THE UNIVERSE
1 credit.

Exploration of the universe via computer simulation of astronomical observations. Examples of topics include telescopes, the distances to stars, the spectra of the stars, star clusters, the Hubble expansion, and the large scale structure of the universe. Discovery through observation, hypothesis, and quantitative analysis is emphasized. Intended to be taken concurrently with ASTRON 103. Prev ASTRON 100 or ASTRON 103 or cons inst acceptable. Satisfies QR-B only if ASTRON 100 or ASTRON 103 is also completed. Not open to stdts who have taken Astron 110

Requisites: Open to all Undergrads.

Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON 114 — HANDS ON THE SOLAR SYSTEM
1 credit.

Exploration via computer simulation of astronomical observations. Examples of topics include the sky and celestial motions, Jupiter’s moons, rocketry, colonization, and extra-solar planets. Naked-eye and telescope observations will also be made. Discovery through observation, hypothesis, and quantitative analysis is emphasized. Intended to be taken concurrently with ASTRON 104. Prev ASTRON 100 or ASTRON 104 or cons inst acceptable. Satisfies QR-B only if ASTRON 104 is also completed. Not open to stdts who have taken Astron 110

Requisites: Open to all Undergrads.

Course Designation: Gen Ed - Quantitative Reasoning Part B
Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2015

ASTRON 150 — TOPICS IN ASTRONOMY
2 credits.

This course will intensively study selected topics of modern astronomy. Examples include missions to the planets, formation of stars and planets, end states of stellar evolution (supernovae, white dwarfs, pulsars, black holes), origin and evolution of the universe.

Requisites: ASTRON 100, 103, or 104, as appropriate for topic, or consent of instructor

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017
ASTRON/GEOSCI 160 — LIFE IN THE UNIVERSE
3 credits.

An examination of the origin and evolution of life in the universe based on our knowledge of astronomy, biology, and geology. Includes discussions on the search for extraterrestrial life and the history of life in our solar system.

Requisites: Open to all undergrads
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 199 — DIRECTED STUDY
1-3 credits.

Open to Fr
Requisites: ASTRON 100 or equiv or cons inst.

Course Designation: Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

ASTRON 200 — THE PHYSICAL UNIVERSE
3 credits.

Modern astrophysics involves applying physical principles to understand astronomical phenomena. Includes the solar system, stars, nebulae, galaxies, and cosmology, with emphasis on origins and evolution. Some nighttime observation with telescopes required. Not open to stdts who have taken ASTRON 100 or 103. Simple calculus required

Requisites: PHYSICS 202 or 208 or cons inst.

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON/HIST SCI 206 — HISTORY OF ASTRONOMY AND COSMOLOGY
3 credits.

The development of astronomical knowledge and cosmological views from the earliest times to the present, viewed in their social, philosophical, and technological contexts.

Requisites: So st
Course Designation: Breadth - Humanities
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Summer 2017

ASTRON 236 — THE HISTORY OF MATTER IN THE UNIVERSE
3 credits.

Multidisciplinary study of how the distribution of elements in the Universe has changed over the last 10-15 billion years by tracing the history of matter from the Big Bang to the present composition of the Earth. The course will emphasize connections between astronomy, geology, and chemistry. Readings will draw both on scientific journals and the popular press to allow us to engage the material on multiple levels. This course meets the University's Com-B requirement. Open to Fr

Requisites: 1 yr college chem or physics, or cons inst.

Course Designation: Gen Ed - Communication Part B
Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Elementary
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON 310 — STELLAR ASTROPHYSICS
3 credits.

Properties of normal and peculiar stars as found from an analysis of the radiation they emit; introduction to radiation transfer. Theory of stellar atmospheres, interiors, and evolution.

Requisites: MATH 222 PHYSICS 205 or 241

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON 320 — THE INTERSTELLAR MEDIUM
3 credits.

Properties of neutral and ionized interstellar gas, giant molecular clouds, the warm and hot intercloud medium, supernova remnants, and interstellar dust. Physical processes in low density gases including radiation transfer, excitation and ionization of interstellar atoms and molecules, and the interaction between gas and dust.

Requisites: MATH 222 and PHYSICS 205 or 241

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 330 — GALAXIES
3 credits.

Distribution of stars, gas, and dust within our Milky Way, and their motions. Nearby galaxies: our Local Group. Optical, radio, and other techniques for observing galaxies. Composition and motions of other galaxies; galaxies with active nuclei; galaxy formation.

Requisites: ASTRON 310

Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016
ASTRON 335 — COSMOLOGY
3 credits.

Introduction to the study of our Universe as a whole. Distribution of matter on the largest scales. Equations for cosmic expansion; making observations in an expanding curved spacetime. Nucleosynthesis and other tests of the Big Bang hypothesis. Gravitational collapse and the growth of structure.

Requisites: ASTRON 310
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2016

ASTRON 340 — SOLAR SYSTEM ASTROPHYSICS
3 credits.

Properties of solar system objects, solar atmospheric phenomena, physics of planetary atmospheres, results of recent planetary missions, comets, origin of the solar system.

Requisites: MATH 222 PHYSICS 205 or 241
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2015

ASTRON 460 — EXPERIENCES IN ASTRONOMICAL OBSERVING
1 credit.

A basic introduction into astronomical research by undertaking a small observing project with optical and/or radio telescopes. Topics covered are: understanding the astronomical literature, observing and data reduction, writing scientific reports and papers, presenting scientific results, and basics of scientific ethics. One of ASTRON 310, 320, 330, or 500 advised

Requisites: Cons inst.
Course Designation: L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2016

ASTRON 500 — TECHNIQUES OF MODERN OBSERVATIONAL ASTROPHYSICS
3 credits.

An introduction to astrophysics data collection. Students will be familiarized with the concepts, techniques, skills and resources needed to plan, obtain, reduce and interpret observations of astronomical objects.

Requisites: Grad st or ASTRON 310 cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 510 — RADIO ASTRONOMY LABORATORY
2 credits.

An introduction to the techniques of modern observational radio astronomy. The course covers fundamentals of radio astronomy, modern radio instrumentation, and observing techniques, through a mixture of classroom lectures, discussions, and hands-on observational projects with a small radio telescope.

Requisites: Cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2012

ASTRON/E M A 550 — ASTRODYNAMICS
3 credits.

Coordinate system transformations, central force motion, two body problem, three and n-body problem, theory of orbital perturbations, artificial satellites, elementary transfer orbits, and elementary rocket dynamics.

Requisites: EMA 202 or 221; or PHYSICS 311 or con reg; or cons inst
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 620 — SEMINAR IN ASTROPHYSICAL TOPICS
1-3 credits.

Current problems; topic changes.

Requisites: ASTRON 310 or cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2017

ASTRON 681 — SENIOR HONORS THESIS
3 credits.

Requisites: Cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Only Courses (H)
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 682 — SENIOR HONORS THESIS
3 credits.

Requisites: Cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Honors - Honors Only Courses (H)
Repeatable for Credit: No
Last Taught: Spring 2017
ASTRON 691 — SENIOR THESIS
2-3 credits.

Requisites: Sr st astronomy-physics major cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON 692 — SENIOR THESIS
2-3 credits.

Requisites: ASTRON 691 cons inst
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2016

ASTRON 699 — DIRECTED STUDY
1-6 credits.

5, Jr or Sr st cons inst
Requisites: L S Undergrads need 2.
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

ASTRON 700 — BASIC ASTROPHYSICS I
2 credits.

Thermodynamics, atomic and molecular spectra, ionization and excitation, line and continuum opacities. Synchrotron radiation, Compton scattering, X-ray spectra. Radiative transfer, simple model atmospheres, radiative and convective energy transport.
Requisites: Grad st in astronomy or physics, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON 702 — BASIC ASTROPHYSICS II
2 credits.

Basic particle and fluid dynamics of stellar and gaseous systems in astrophysics. Review of gravitational dynamics, 2-body relaxation, phase space, basic equations of fluid dynamics, waves, shocks, winds accretion, instabilities.
Requisites: Grad st in astronomy or physics, or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 715 — STELLAR INTERIORS AND EVOLUTION
2 credits.

Physical principles, equilibrium of gaseous spheres, energy transport, energy generation, nucleosynthesis, main sequence red giant and electron degenerate stars. Advanced topics such as origins of stellar variability, binary star evolution, star formation, supernovae explosions, evolution with mass loss.
Requisites: ASTRON 700 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

ASTRON 720 — THE INTERSTELLAR MEDIUM I: BASIC PROCESSES
2 credits.

Observational techniques for interstellar medium studies, overview of the role of interstellar gas in galaxies, dynamics, energetics, major theories of structure and evolution, introduction to star formations and supernova remnant evolution.
Requisites: ASTRON 700
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2015

ASTRON 730 — GALAXIES
2 credits.

Stellar content and dynamics of the Milky Way and other galaxies; galaxy types, evolution of normal galaxies, active nuclei, quasars, radio galaxies.
Requisites: Grad st in Astron or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

ASTRON 735 — OBSERVATIONAL COSMOLOGY
2 credits.

Extragalactic distance scale; groups and clusters of galaxies; distribution of galaxies and radio sources. Introduction to general relativity, cosmological models, microwave background, early universe, galaxy formation.
Requisites: Grad st in Astron or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON/PHYSICS 910 — SEMINAR IN ASTROPHYSICS
1 credit.

Current topics.
Requisites: Cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2016
ASTRON 920 — SEMINAR-ASTROPHYSICAL TOPICS
1-3 credits.

Current problems; topic changes.
Requisites: Grad st in astron or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2016

ASTRON 990 — RESEARCH AND THESIS
1-12 credits.

Requisites: Grad st in astron
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017

ASTRON 999 — ADVANCED INDEPENDENT READING
1-2 credits.

Requisites: Grad st in astron
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2017