ASTRONOMY (ASTRON)

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. Enroll Info: Completion of QR-A. Open to all Undergrads. Stdts may not receive cr for both Astron 100 103. Not open to stdts who meet prereq for ASTRON 200
Requisites: Satisfied Quantitative Reasoning (QR) A requirement
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: Fall 2018

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. Enroll Info: Completion of QR-A. Open to all Undergrads. Stdts may not receive cr for both Astron 100 104
Requisites: Satisfied Quantitative Reasoning (QR) A requirement
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: Fall 2018

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. Enroll Info: Open to all Undergrads. 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: Must have taken or are currently taking Astronomy 104.
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 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. Enroll Info: Open to all Undergrads. 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: Must have taken or are currently taking Astronomy 104.
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 2018

ASTRON 140 — EARTH 2.0: THE EXOPLANET REVOLUTION
3 credits.

Our Galaxy contains about 100 billion stars. Most of these stars have planets as diverse and as fascinating as the worlds in our own neighborhood, the solar system. Learn about the study of planets and exoplanets, probing some of the deepest questions science and philosophy grapple with. Explore the ways in which scientists search for and analyze planets orbiting distant stars, both in the classroom and in hands-on laboratory experiences. From moons to super-Jupiters, this course provides an engrossing introduction into the brand new science of exoplanet research. Enroll Info: Satisfied Quantitative Reasoning A requirement
Requisites: Satisfied Quantitative Reasoning (QR) A requirement
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 2018

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. Enroll Info: None
Requisites: ASTRON 100, ASTRON 103, or ASTRON 104
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
Astronomy (ASTRON)

ASTRON/GEOSCI 160 — LIFE IN THE UNIVERSE
2 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. Enroll Info: None

Requisites: None

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 2018

ASTRON 199 — DIRECTED STUDY
1-3 credits.

Enroll Info: Astron 100 or equiv or cons inst. Open to Fr

Requisites: Consent of instructor

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: Spring 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. Enroll Info: PHYSICS 202 or 208 or cons inst. Not open to stdts who have taken Astron 100 or 103. Simple calculus required

Requisites: None

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 2018

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. Enroll Info: So st

Requisites: None

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 2018

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. Enroll Info: 1 yr college chem or physics, or cons inst. Open to Fr

Requisites: None

Course Designation: Gen Ed - Communication Part B

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Fall 2018

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. Enroll Info: MATH 222

PHYSICS 205 or 241

Requisites: None

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 2018

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. Enroll Info: MATH 222 and PHYSICS 205 or 241

Requisites: None

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. Enroll Info: ASTRON 310

Requisites: None

Course Designation: Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No

Last Taught: Fall 2018
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. Enroll Info: ASTRON 310
Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

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. Enroll Info: MATH 222 PHYSICS 205 or 241
Requisites: None
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 2017

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. Enroll Info: Cons inst. One of ASTRON 310, 320, 330, or 500 advised
Requisites: Consent of instructor
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2018

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. Enroll Info: None
Requisites: None
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. Enroll Info: EMA 202 or 221; or PHYSICS 311 or con reg; or cons inst
Requisites: None
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 2018

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

Current problems; topic changes. Enroll Info: ASTRON 310 or cons inst
Requisites: None
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.

Enroll Info: None
Requisites: Consent of instructor
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: Fall 2018

ASTRON 682 — SENIOR HONORS THESIS
3 credits.

Enroll Info: None
Requisites: Consent of instructor
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 2018
ASTRON 691 — SENIOR THESIS
2-3 credits.
Enroll Info: Sr st astronomy-physics major cons inst
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017

ASTRON 692 — SENIOR THESIS
2-3 credits.
Enroll Info: ASTRON 691 cons inst
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

ASTRON 699 — DIRECTED STUDY
1-6 credits.
Enroll Info: L S Undergrads need 2.5, Jr or Sr st cons inst
Requisites: Consent of instructor
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: Fall 2018

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. Enroll Info: Grad st in astronomy or physics, or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2018

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. Enroll Info: Grad st in astronomy or physics, or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2018

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. Enroll Info: ASTRON 700 or cons inst
Requisites: Graduate/professional standing
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. Enroll Info: ASTRON 700
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

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. Enroll Info: Grad st in Astron or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

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. Enroll Info: Grad st in Astron or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2016

ASTRON/PHYSICS 910 — SEMINAR IN ASTROPHYSICS
0-1 credits.
Current topics. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2018
ASTRON 920 — SEMINAR-ASTROPHYSICAL TOPICS
1-3 credits.

Current problems; topic changes. Enroll Info: Grad st in astron or cons inst
Requisites: Graduate/professional standing
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.

Enroll Info: Grad st in astron
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2018

ASTRON 999 — ADVANCED INDEPENDENT READING
1-2 credits.

Enroll Info: Grad st in astron
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2008