***821. Art Instructional Media Laboratory I—Multi-Media***

*Fall, Winter, Spring, Summer. 4(1-9) May reenroll for a maximum of 8 credits. Approval of department.*

Investigation of multi-media techniques as media of artistic expression and communication for application to art education or related fields.

***822. Art Instructional Media Laboratory II—Television***

*Fall, Winter, Spring, Summer. 4(1-9) May reenroll for a maximum of 8 credits. Approval of department. Interdepartmental and jointly administered with the Department of Telecommunication.*

Analysis of teaching video tapes and television programs in art. Utilization of television as a medium of artistic expression and communication for application to art education or related fields.

***825. Seminar in Art Education***

*Fall, Winter, Spring, Summer. 2 to 4 credits. May reenroll for a maximum of 8 credits. Approval of department.*

Examination and discussion of contemporary thought in the field of art education. Current problems examined within an interdisciplinary framework.

***826. Critical Theory and Aesthetic Experience in Art Education***

*Fall, Winter, Spring, Summer. 3(3-0) May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.*

Theories of art criticism and aesthetic experience. Organization of these concepts for application to art education programs or related fields.

***827. Curriculum Design for Art Education***

*Fall, Winter, Spring, Summer. 3(3-0) May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.*

Factors affecting art curriculum; analysis, preparation and evaluation.

***828. Research Methods for Art Education***

*Fall, Winter, Spring, Summer. 3(3-0) May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.*

Orientation to research; designs and methodologies applicable to the study of problems in art education.

***840. Teaching Seminar—Art Practice***

*Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Approval of department.*

Supervised teaching of college classes in art practice.

***899. Master's Thesis Research***

*Fall, Winter, Spring. Variable credit. May reenroll for a maximum of 12 credits. Approval of department.*

## ARTS AND LETTERS — A L

### College of Arts and Letters

***390H. Perspectives in Literature***

*Fall. 4(3-0) Juniors, approval of Honors College.*

Attention will be focused on several major literary works. Students will employ various types of literary analysis, considering theme, idea, structure, etc., and examining some major trends in contemporary literary criticism.

***391H. Perspectives in Philosophy***

*Winter. 4(3-0) Juniors, approval of Honors College.*

The two primary areas of concern will be ethics and aesthetics, the emphasis on one or the other to be determined by the professor. The course will include reading of major works, discussion of major figures in the fields, and the preparation of a substantial paper.

***392H. Perspectives in History***

*Spring. 4(3-0) Juniors, approval of Honors College.*

The focus will be on the nature of international diplomacy in the 20th century, the development of nationalism, the balance of power system, the influence of new ideologies, and the developments of the power structure since 1945.

***393H. Perspectives in 20th Century Arts: 1900-1920***

*Fall. 3(3-0) Juniors, approval of Honors College.*

Reaction to Naturalism across the arts traced in Symbolism and Expressionism as interrelated phenomena in response to the crisis of confidence in European institutions.

***394H. Perspectives in 20th Century Arts: 1920-1945***

*Winter. 3(3-0) Juniors, approval of Honors College.*

Formalist analysis of art elements examined across the arts in Cubism, Surrealism and new musical structures as positive response to war, depression and dictatorship.

***395H. Perspectives in Contemporary Arts: Postwar Period***

*Spring. 3(3-0) Juniors, approval of Honors College.*

The function of avant-garde arts after World War II to the present studied in the new dimensions of an environment created by new technology and the mass media explosion.

***450. Arts Management***

*Fall, Winter, Spring. 3 to 5 credits. May reenroll for a maximum of 9 credits. Seniors or Graduate Students or approval of department.*

Administration of arts organizations, management of facilities, understanding operational methods and procedures of performing companies, financial structure and funding of arts centers, study of audience development, contemporary trends in arts management field.

***461. Aging and Human Values***

*Spring. 3(3-0) Juniors.*

Development of personal and professional responses to value-laden questions concerning aging and the elderly through historical, literary, philosophical and related perspectives.

***491H. Perspectives in the Social Sciences and Humanities***

*Fall, Winter, Spring. 2 to 6 credits. May reenroll for a maximum of 12 credits if different topic is taken. Juniors, approval of Honors College, or approval of instructor. Interdepartmental with the College of Social Science and Justin Morrill Inter-College Programs.*

An integration of subject matter and methodologies of several disciplines as they are relevant to particular topic areas.

***492. Integrative Studies in the Humanities***

*(U C 492.) Fall, Winter, Spring. 4(4-0) May reenroll for a maximum of 8 credits. Juniors or approval of department.*

In-depth study of topics in the humanities. Integrative and interdisciplinary approach.

***499. Arts and Letters Internship***

*Fall, Winter, Spring, Summer. 1 to 10 credits. May reenroll for a maximum of 10 credits. Juniors, 3.00 GPA, approval of instructor.*

Supervised pre-professional field experience for juniors, seniors, or graduate students.

***999. Doctoral Dissertation Research***

*Fall, Winter, Spring, Summer. Variable credit. May reenroll for a maximum of 36 credits. Approval of college.*

## ASTRONOMY AND ASTROPHYSICS — AST

### College of Natural Science

***109. Astronomical Fiction***

*Winter. 1(1-0) AST 119 concurrently.*

Concurrent readings of works of science fiction to assist the visualization of the concepts presented in AST 119.

***115. Exploring Cosmology***

*Spring. 2(2-0) Not open to engineering or physical science majors.*

Nonmathematical view of the origin, history, and overall structure of the universe, based on the Big Bang model of cosmology.

***117. Introductory Observing***

*Fall, Spring. 2(1-2) AST 119, or AST 217, or AST 229 or concurrently and approval of department.*

Observations of celestial objects, constellation identification, and occasional planetarium exercises.

***119. General Astronomy (N)***

*Fall, Winter, Spring, Summer. 4(4-0) Not open to engineering or physical science majors. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229.*

A qualitative presentation of man's current view of the universe including birth and death of stars, cosmology, comparisons of planets, and life in the universe.

*120. Topics in Astronomy*

*Winter, Spring. 4(4-0) AST 119.*

Detailed qualitative discussion of currently interesting topics in astronomy. May include such topics as quasars, pulsars, black holes, planetary exploration, cosmology, concepts of relativity.

*217. General Astronomy (N)*

*Fall, Winter, Spring. 4(4-0) MTH 102 or MTH 109 or MTH 111. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229.*

Intended primarily for physical science majors. A semiquantitative presentation of current views of the universe including birth and death of stars, cosmology, comparisons of planets, and life in the universe.

*229. General Astronomy*

*Fall. 4(4-0) PHY 287 or PHY 291H or concurrently; MTH 113. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229.*

Fundamental observations in astronomy and their interpretation through physical laws. Intended for physical science majors and recommended for astrophysics majors. Quantitative discussion of orbital motion, time, telescopes, solar system, stars, galaxies, and cosmology. Limited opportunity for astronomical obsevations.

*327. Practical Astronomy*

*Winter. 3(3-0) AST 217 or AST 229, MTH 113.*

Celestial coordinate systems. Time conversion and sidereal time. Atmospheric refraction, parallax, proper motion, aberration, and precession. Star catalogs and ephemerides. Finding charts and setting of equatorial telescopes.

*378. Contemporary Astronomy*

*Winter. 3(3-0) AST 217 or AST 229.*

A continuation of General Astronomy with particular emphasis on modern developments. May include such topics as planetary exploration, interstellar matter, star formation, stellar evolution through final stages, supernovae, pulsars, neutron stars, black holes, galaxies, and cosmology.

*437. Observatory Practice*

*Spring. 3(1-4) AST 327 and approval of department.*

Stellar photography. Photographic photometry. Photoelectric photometry and corrections for atmospheric extinction. Multicolor photometric systems. Astronomical spectroscopy and radial velocity determinations.

*458. Astrophysics*

*Winter. 3(3-0) AST 217 or AST 229, PHY 289, PHY 395, or approval of department.*

Application of physical principles to the atmospheres and interiors of stars to deduce their physical properties. Discussion of radiation, spectra and gas properties.

*459. Solar System Physics*

*Spring. 3(3-0) PHY 289 or approval of department.*

Physical properties of the sun, interplanetary space, planets, and satellites as deduced from terrestrial observations and from space probes. Recent results of the NASA space program will be emphasized.

*490. Special Problems*

*Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 10 credits. Approval of department.*

Individual study or project under the direction of a faculty member. An oral report on the work may be required in department seminar.

*800. Research Methods*

*Fall, Winter, Spring, Summer. 2(0-6) May reenroll for a maximum of 6 credits. Beginning graduate students. Interdepartmental with and administered by the Department of Physics.*

Problems and techniques of current research by taking part in the design and setup of experiments, data taking and reduction; study and practice of theoretical methods. Areas of study: solid state and molecular structure, nuclear, elementary particles, astronomy, astrophysics.

*801. Seminar*

*Winter. 1(1-0) May reenroll for a maximum of 2 credits. Graduate students or approval of department.*

Seminars to be presented by both faculty and students to review papers in the current astronomical research literature.

*819. Stellar Structure*

*Spring of even-numbered years. 3(3-0) AST 458 or PHY 395 or approval of department.*

Physical properties of the stellar interior. Methods of calculating models. Stellar evolution. Comparison of theory with current observations.

*828. Galactic Structure*

*Winter of even-numbered years. 3(3-0) PHY 427 or approval of department.*

Distribution and dynamics of stars and interstellar material in our galaxy. Spiral structure. Galactic evolution.

*850. Ionized Gases*

*Fall. 3(3-0) E E 835 or PHY 448; E E 874. Interdepartmental with Electrical Engineering and the Department of Physics and administered by Electrical Engineering.*

Elastic collision processes; Boltzmann equation; moment equations; motion of a charged particle in electrical and magnetic field; individual and collective charged particle behavior; macroscopic properties of plasmas, waves in the fluid plasma; transport phenomena in plasma.

*859. Stellar Atmospheres*

*Spring of odd-numbered years. 3(3-0) AST 458 or PHY 395 or approval of department.*

The physics of radiation and the equation of its transfer. Theory of absorption coefficient and line absorption profile. The gray atmosphere and calculation of model atmospheres.

*860. General Relativity and Cosmology I*

*Fall of even-numbered years. 3(3-0) PHY 858 or approval of department. Interdepartmental with and administered by the Department of Physics.*

Conceptual foundations of general relativity theory; elements of tensor calculus; Riemann-Christoffel curvature tensor; the field equations; experimental tests; special solutions; the extension to cosmology.

*861. General Relativity and Cosmology II*

*Winter of odd-numbered years. 3(3-0) PHY 860. Interdepartmental with and administered by the Department of Physics.*

Relativistic cosmology: the model universes; stead-state theory; observational evidence and possibilities for decision among models; current problems.

*984. Advanced Readings in Physics or Astronomy*

*Fall, Winter, Spring, Summer. Variable credit. Interdepartmental with and administered by the Department of Physics.*

*989. Waves and Radiations in Plasmas*

*Winter of odd-numbered years. 3(3-0) E E 850. Interdepartmental with the Department of Physics, and Electrical Engineering. Administered by Electrical Engineering.*

Plasma oscillation; interaction, electromagnetic fields with plasmas, wave propagation in magnetionic media; plasma sheath; radiation of electric source in incompressive and compressive plasmas; electroacoustic waves; magnetohydrodynamics; research topics in plasmas.

## AUDIOLOGY AND SPEECH SCIENCES ASC

### College of Communication Arts and Sciences

*108. Voice and Articulation*

*Fall, Winter, Spring, Summer. 3(4-0)*

The study and development of the skills of voice and articulation.

*222. Oral Language Development*

*Winter, Summer. 3(2-0)*

Emergence and development of receptive and expressive aspects of oral language of the child.

*227. Physics for Audiology and Speech Sciences*

*Fall, Spring. 3(3-0) MTH 108. Not open to students with credit in PHY 237. Interdepartmental with and administered by the Department of Physics.*

Introductory physics for Audiology and Speech Sciences majors: kinematics, Newtons' Law, conservation of energy and momentum, waves and vibrations, sound propagation, resonance, speech production.

*274. Structures and Functions of Speech and Hearing Mechanisms*

*Fall, Winter. 5(4-2) ASC 108 or approval of department.*

Peripheral and central auditory mechanisms and the respiratory, phonatory and articulatory mechanisms for speech.

*276. Descriptive Phonetics*

*Winter, Spring. 3(3-0) ASC 274 or approval of department.*

Detailed description of the principles that underlie the production of speech sounds.

*277. Scientific Bases of Voice Communication Process*

*Fall, Spring. 3(3-0) ASC 276 and PHY 237 or approval of department.*

Scientific bases of voice communication with special reference to the acoustic aspect of production.