

**ARTS AND LETTERS                    A L**

**College of Arts and Letters**

**390H. Perspectives in Literature**

Fall. 4(3-0) Juniors, approval of the 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 the 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 field, and the preparation of a substantial paper.

**392H. Perspectives in History**

Spring. 4(3-0) Juniors, approval of the 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.

**450. Arts Management**

Fall, Winter, Spring. 3 to 5 credits. May re-enroll 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.

**999. Research**

Fall, Winter, Spring, Summer. Variable credit. May re-enroll for maximum of 36 credits. Approval of college.

**ASTRONOMY                                    AST**

**College of Natural Science**

**119. General Astronomy**

Fall, Winter, Spring, Summer. 4(4-0) Not open to engineering or physical science majors or minors.

Physical nature of solar system, star clusters, and galaxies as seen by modern astronomers. Limited opportunity for astronomical observations.

**120. Topics in Astronomy**

Winter, Spring. 4(4-0) 119. Detailed qualitative discussion of currently interesting topics in astronomy. Quasars, pulsars, black holes, planetary exploration, cosmology, concepts of relativity.

**203. Introduction to Study of the Moon**

For course description, see Interdisciplinary Courses.

**217. General Astronomy**

Fall, Winter. 4(4-0) MTH 102. Descriptive course intended primarily for physical science majors. A semi-quantitative discussion of time, telescopes, the solar system, stars, clusters of stars, galaxies, and cosmology. Limited opportunity for astronomical observations.

**229. General Astronomy**

Spring. 4(4-0) PHY 287 or 291 or concurrently. Students may not receive credit in more than one of the following: 119, 217, 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 observations.

**327. Practical Astronomy**

Spring. 3(3-0) 217, 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) 119 or 217 or 229; MTH 113 recommended.

A continuation of General Astronomy with particular emphasis on modern developments. Includes interstellar matter, star formation, stellar evolution through final stages, supernovae, pulsars, neutron stars, galaxies and cosmology.

**437. Observatory Practice**

Fall. 3(1-4) 327. 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) 217 or 229, PHY 289, 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**

Fall. 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. 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.

**801. Seminar**

Winter. 1(1-0) May re-enroll 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) 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.

**829. Extragalactic Astronomy and Observational Cosmology**

Spring of even-numbered years. 3(3-0) Approval of Department.

Properties of galaxies, including evolution. Luminosities, masses, and clustering tendencies. The velocity-distance relation and the extragalactic distance scale. Radio sources, quasars, cosmic microwave background radiation.

**850. Ionized Gases**

Spring. 3(3-0) E E 835 or PHY 448. Interdepartmental with the Physics Department and Electrical Engineering, and administered by Electrical Engineering.

Elastic collision processes; Boltzmann equation; moment equations; basic plasma phenomena; motion of a charged particle in electrical and magnetic field; individual and collective charged particle behavior.

**859. Stellar Atmospheres**

Spring of odd-numbered years. 3(3-0) 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 859 or approval of department. Interdepartmental with and administered by the Physics Department.

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) 860. Interdepartmental with and administered by the Physics Department.

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

**989. Waves and Radiations in Plasmas**

Fall of even-numbered years. 3(3-0) 850. Interdepartmental with the Physics Department and Electrical Engineering, and administered by Electrical Engineering.

Plasma oscillation; interaction, electromagnetic fields with plasmas, wave propagation in magnetized media; plasma sheath; radiation of electric source in incompressible and compressive plasmas; electroacoustic waves; magneto-hydrodynamics; research topics in plasmas.

**AUDIOLOGY AND SPEECH SCIENCES                                    ASC**

**College of Communication Arts**

**093. Remedial Speech**

Fall, Winter, Spring, Summer. 0(2-0) [2(2-0)]†.

Special help in relieving or compensating for disorders of speech.

**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.

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

(854A., 475.) Fall, Winter. 3(3-0)

108 or approval of department.

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

**276. Descriptive Phonetics**

(275.) Winter, Spring. 3(3-0) 274

or approval of department.

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

**277. Scientific Bases of Voice Communication Process**

(275.) Fall, Spring. 3(3-0) 276

and PHY 237 or approval of department.

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

**372. Speech Pathology I**

Fall, Winter. 5(3-0) 276, 277.

Etiology, symptomatology, and rationale of therapy for speech and language problems.

**373. Clinical Procedures in Speech Pathology and Audiology**

Winter, Spring. 4(2-2) 2.00 grade-point average in 277 and 372 or approval of department.

Principles underlying the clinical interview and client relationships essential to diagnosis and therapy. Procedures in obtaining, recording, and evaluating test results and therapeutic methods.

**444. Oral Language of Urban Areas**

Winter, Summer. 3(3-0)

Concentration in the characteristics of language and human communication as these relate to studies and practices of those involved in urban affairs.

**454. Audiology I**

Fall, Spring. 5(4-1) 276, 277.

Fundamental aspects of hearing; nature, testing and rehabilitation.

**460. Audiology II**

Winter, Summer. 5(3-0) 454 or approval of department.

Theory and methodology in the teaching of lip-reading and auditory training to the acoustically handicapped.

**470. Speech Correction for Teachers**

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

Juniors. Not open to speech pathology and audiology majors.

Meeting needs of the speech handicapped child in classroom.

**474. Clinical Practicum in Speech and Language Pathology**

Fall, Winter, Spring, Summer. 1 credit. May re-enroll for a maximum of 2 credits. Grade of 2.0 or better in both 372 and 373.

Therapeutic experience in speech and language pathology.

**476. Speech Pathology II: Diagnostics**

(473.) Fall, Winter, Spring, Summer. 5(3-2) 474 or approval of department.

Test procedures and analysis; supervised clinical experience in language and speech evaluations and report writing.

**477. Methods in Public School Speech and Hearing Therapy**

Fall, Winter, Spring. 4(3-4) 372.

Must be taken prior to term of student teaching. Administration and organization, procedures and materials in public school speech and hearing therapy.

**499. Independent Study**

Fall, Winter, Spring, Summer. 1 to 6 credits. May re-enroll for a maximum of 12 credits. Approval of department.

**801. Advanced Study of Articulatory Behavior**

Fall. 4(3-1) Approval of department.

Theoretical and pragmatic implications of the interrelationships of articulatory behavior and language production, especially as related to investigating procedures and results.

**831. Speech and Hearing Problems of Adults**

A. NEUROPATHOLOGIES OF SPEECH

Winter. 4(3-0)

Neuropathology, symptomatology, and speech and language rehabilitation of adults.

B. VOICE DISORDERS

Spring. 4(3-0)

Etiology, symptomatology, and therapeutic procedures for disorders of voice. Speech pathologist and audiologist in relation to other disciplines in the rehabilitation of adults with voice disorders.

**832. Speech and Hearing Evaluation and Therapy**

A. HEARING HANDICAP

Summer. 4(2-2)

A theoretical approach to the study of the aural rehabilitative process.

B. CEREBRAL PALSY

Spring. 4(3-0)

Etiology, symptomatology, structural and functional consideration of cerebral palsy. Therapeutic procedures for the speech of the cerebral palsied.

C. DELAYED LANGUAGE DEVELOPMENT

Winter. 4(3-0)

Evaluative techniques including audiometry, psychometry, and case history as aids to the differential evaluation of delayed language development.

D. MENTAL RETARDATION

Summer. 4(3-0)

Language behavior and speech development of the mentally retarded as related to all facets of personal-social development and adjustment.

E. STUTTERING

Summer. 4(3-0)

Longitudinal studies of stuttering theories and the therapies accompanying them.

F. CLEFT PALATE

Fall. 4(2-0)

Etiology, symptomatology, structural and functional consideration of cleft palate. Therapeutic procedures for the speech habilitation of cleft palate individuals.

**833. Specialized Clinical Audiology**

A. DIFFERENTIAL AUDIOMETRY

Fall. 4(3-0)

Pure tone audiometric tests as an aid to the otologist in evaluating the pathology of hearing loss; including the development of norms. Consideration of nonorganic loss.

**B. SPEECH AUDIOMETRY AND EVALUATION OF HEARING AIDS**

Fall. 4(4-0)

Speech audiometry; principles and methods in the selection of hearing aids; physical characteristics of hearing aids.

**C. INDUSTRIAL AUDIOLOGY**

Spring. 4(2-2)

Evaluation of the role of the audiologist in industry emphasizing identification procedures, damage-risk criteria, measurement and control of noise, conservation procedures, and medico-legal problems.

**D. ADVANCED AUDIOLOGICAL EVALUATION**

Winter. 4(3-1)

Theory, administration and evaluation of selected tests including Bekesy, EDR, EEG, and advanced speech-audiometric tests.

**E. PEDIATRIC AUDIOLOGY**

Winter. 4(2-2)

Evaluative procedures including play audiometry, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; rehabilitative procedures for the acoustically handicapped child.

**853. Speech Perception: Theory and Measurement**

Spring. 4(4-0) Approval of department.

Evaluation and analysis of various theories of speech perception and their implications for speech and language pathologists, audiologists, and speech and hearing scientists.

**854. Psychophysics and Theories of Audition**

(854B.) Summer. 4(3-0)

Nature of auditory stimuli and the results of psychophysical experimentation in audition.

**874. Speech and Hearing Problems in Public Schools**

Summer. 4(3-0) May re-enroll for a maximum of 16 credits.

Graduate seminar in speech and hearing involving problems that arise in relation to speech and hearing therapy in the public schools.

**876. Communication Disorders: Neuroanatomy-Neurophysiology**

Fall. 4(3-1) Approval of department.

Neuroanatomical and neurophysiological correlates of speech, language, and hearing.

**880A. Algorithms for Speech and Hearing Sciences**

Fall. 4(4-0)

A discussion of useful algorithms applicable to quantification of phenomena related to audiology and speech sciences.

**880B. Acoustic Phonetics**

Winter. 4(2-2) 880A or approval of department.

An analytic study of the acoustics of speech.

**880C. Instruments and Electronics for Audiology and Speech Sciences**

Spring. 4(3-3) 880B or approval of department.

A discussion of the electronic principles and instruments necessary to measure parameters related to hearing and speech processes.

**880D. Experimental Phonetics**

Summer. 4(2-0) 880C or approval of department.

Critical review of the literature in experimental phonetics with special reference to the historical development of the field and subsequent experimentation in physiological and acoustical phonetics.

**899. Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**940. Seminar in Audiology and Speech Sciences**  
Spring, Summer. 4(2-0) May re-enroll for maximum of 16 credits.

**990. Special Problems in Audiology and Speech Sciences**  
Fall, Winter, Spring, Summer. 1 to 6 credits.  
Special projects in audiology and speech sciences.

**999. Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## BIOCHEMISTRY BCH

College of Agriculture and Natural Resources  
College of Human Medicine  
College of Natural Science  
College of Osteopathic Medicine

**200. Introduction to Biochemistry**  
Winter, Summer. 5(5-0) Credit may not be earned in both 200 and 401. General chemistry; one term organic chemistry. Not acceptable for a B.S. degree in biochemistry. Survey of biochemistry emphasizing the major metabolic activities of living organisms.

**363. Clinical Biochemistry**  
Spring. 3(2-3) 401; CEM 162. Primarily for Medical Technology majors; not acceptable for a B.S. degree in biochemistry. Quantitative clinical laboratory methods.

**400H. Honors Work**  
Fall, Winter, Spring. Variable credit. Approval of department.  
Assigned reading and experimentation.

**401. Basic Biochemistry**  
Fall, Summer. 5(5-0) Credit may not be earned in both 200 and 401. One year organic chemistry or CEM 242; not open to biochemistry majors.  
A one-term presentation of biochemistry emphasizing structure and function of major biomolecules, metabolism and regulation. Examples used for illustrative purposes will emphasize the mammalian organism.

**404. General Biochemistry Laboratory**  
Fall, Winter, Spring. 3(1-6) Analytical chemistry; 401 or 451.  
Experimental aspects of biochemistry.

**451. Biochemistry**  
Fall. 4(4-0) Credit may not be earned in both 401 and 451. One year organic chemistry or CEM 242.

A comprehensive presentation of biochemistry designed for undergraduate biochemistry majors, students of medicine, and other students desiring an intensive treatment of the subject.

**452. Biochemistry**  
Winter. 4(4-0) 451.  
Continuation of 451.

**499. Research**  
Fall, Winter, Spring, Summer. 1 to 4 credits. May re-enroll for a maximum of 12 credits. Approval of department.  
A course designed to give qualified undergraduate students an opportunity to gain experience in biochemical research.

**501. Medical Biochemistry**  
Fall, Winter. 3(3-0) One year organic chemistry, or CEM 242. Fall: Osteopathic Medicine students; Winter: Human Medicine students; Others approval of department.  
Basic biochemical principles and terminology of importance in medical biology.

**801. Biochemical Research Methods**  
Fall. 1(0-3) One year of organic chemistry or CEM 242; BCH 451 or 811, or concurrently.  
Discussions and demonstrations of selected experimental techniques of wide application in biochemistry.

**804. Advanced Biochemistry Laboratory**  
Fall. 3(1-6) Analytical chemistry; 801 and 811, or concurrently; biochemistry majors or approval of department.  
Experiments to be selected from a representative group illustrating modern biochemical research.

**805. Advanced Biochemistry Laboratory**  
Winter. 3(1-6) 804; 812 concurrently.  
Experiments to be selected from a representative group illustrating modern biochemical research.

**806. Advanced Biochemistry Laboratory**  
Spring. 3(1-6) 805; 813 concurrently.  
Special experiments in advanced laboratory techniques.

**811. Advanced Biochemistry**  
Fall. 4(4-0) One year of organic chemistry, one year of physical chemistry, one term of introductory biochemistry, 801 taken previously or concurrently, or approval of department. Limited to graduate students in biochemistry or other students needing a similar professional preparation.  
The structure and function of biomolecules, energy transformations and chemical reactions in living cells, regulation of cell reactions, and the replication of living organisms.

**812. Advanced Biochemistry**  
Winter. 4(4-0) 811  
Continuation of 811.

**813. Advanced Biochemistry**  
Spring. 4(4-0) 812.  
Continuation of 812.

**855. Special Problems**  
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.  
Consideration of current problems.

**899. Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

**952. Plant Physiology and Biochemistry I**  
Winter of odd-numbered years. 3(3-0)  
Approval of department. Interdepartmental with the Botany and Plant Pathology Department.

Selected topics concerning photosynthesis and related processes.

**955. Plant Physiology and Biochemistry II**  
Winter of even-numbered years. 3(3-0)  
Approval of department. Interdepartmental with the Botany and Plant Pathology Department.  
Metabolic pathways of unique significance to plants.

**960. Selected Topics in Biochemistry**  
Fall, Winter, Spring, Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department.

Topics will be selected from the areas of biochemical genetics, biochemistry of development, biochemical evolution, complex proteins, lipid metabolism, immunochemistry, hormones, control mechanisms and structure of biological macromolecules.

**961. Selected Topics in Biochemistry**  
Fall, Winter, Spring, Summer. 1(1-0) or 2(2-0) May re-enroll for a maximum of 6 credits if a different topic is taken. Approval of department.

Topics will be selected from the areas of bioenergetics, bioinstrumentation, complex carbohydrates, mechanisms of enzyme action, natural products, carbohydrate metabolism, mass spectrometry and biochemistry of isoprenoid compounds.

**978. Seminar in Biochemistry**  
Fall, Winter, Spring. 0 or 1(1-0)  
Presentation and discussion of reports by graduate students on biochemical topics of current interest.

**999. Research**  
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

## BIOLOGICAL SCIENCE B S

College of Natural Science

**200. Studies in Contemporary Biological Science**  
Spring. 4(3-3) 12 credits in a Department of Natural Science sequence.

Biological topics impacting contemporary, American and world society are studied in the context of major biological themes and individual laboratory investigation of a self chosen topic.

**202. Biological Science for Elementary Teachers**  
Fall, Winter, Spring. 4(3-3)

Fundamental principles of biology which provide background appropriate for preparation for elementary education teaching.

**\*210. General Biology**  
Fall, Spring. 4(4-2)

Concepts relating to basic attributes and diversity of living things.

\*For prerequisite purposes, the introductory biology sequence in Lyman Briggs College, LBC, 140, 141, 242, may be used instead of this sequence.