ARTS AND LETTERS

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, 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 ideas, 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, and diplomacy. 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 ideas, and the preparation of a substantial paper.

ASTRONOMY

College of Natural Science

119. General Astronomy
Fall, Winter, Spring. 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.

201. Introduction to 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. 3(4-0) PHY 207 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 system, time conversion and time structure, atmospheric refraction, parallax, proper motion, aberration, and precession. Star catalogs and ephemerides. Finding charts and setting of equatorial telescopes.

375. Contemporary Astronomy
Spring. 3(3-0) 119 or 217 or 229; MTH 113 recommended.
A continuation of General Astronomy with particular emphasis on modern developments. Includes interferometer, star formation, stellar evolution through supernovae. Spectra and gas properties, stellar properties of the sun, interplanetary media, radiation of the sun and solar wind.

437. Observatory Practice
Fall. 3(1-4) 317.

458. Astrophysics
Winter. 3(3-0) 207 or 229; PHY 299, or approval of department.
Application of physical principles to the atmosphere 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 299 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.

501. Seminar
Winter. 1(1-0) May be re-enrolled for a maximum of 2 credits. Graduate students or approval of department.
Seminar is to be presented by both faculty and students to review papers in the current astronomical research literature.

819. Stellar Structure
Spring. 3(3-0) 458 or PHY 395 or approval of department.

528. Galactic Structure
Winter. 3(3-0) PHY 457 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.

550. Ionized Gas
Spring. 3(3-0) 448 or PHY 448. Interdepartmental with the Physics Department and Electrical Engineering, and administered by Electrical Engineering.
Electron collision processes; Boltzmann equation; moment equations; classical plasma phenomena; motion of a charged particle in electrical and magnetic fields; individual and collective charged particle behavior.

858. Stellar Atmospheres
Spring of odd-numbered years. 3(3-0) 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 grey atmosphere and calculation of model atmospheres.

860. General Relativity and Cosmology I
Fall of even-numbered years. 3(3-0) or PHY 355 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) or PHY 355 or approval of department.
Interdepartmental with and administered by the Physics Department.
Relativistic cosmology: the model universes; stead-state theory; observational evidence and possibilities for decision among models; current problems.

899. Waves and Radiations in Plasmas
Fall of even-numbered years. 3(3-0)
Interdepartmental with and administered by the Physics Department and Electrical Engineering.
Plasma oscillations; interactions, electromagnetic fields with plasmas, wave propagation in magnetized media; plasma sheaths; radiation of electric source in incompressible and compressive plasmas, electroacoustic waves, magnetohydrodynamics; research topics in plasmas.

Audiology and Speech Sciences

College of Communication Arts

693. Remedial Speech
Fall, Winter, Spring, Summer. 0(3-0)
[2(3-0)]J.
Special help in relieving or compensating for disorders of speech.

105. Voice and Articulation
Fall, Winter, Spring, Summer. 3(4-0)
The study and development of the skills of voice and articulation.
Scrupulous — Audiology and Speech Sciences

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) 105 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 275 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) 3.00 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)
Junior. 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 8 credits. May re-enroll for a maximum of 12 credits. Approval of department.

501. 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(2-3)
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 audiology, psychology, 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. CLIFT PALATE
Fall. 4(2-0)
Etiology, symptomatology, structural and functional considerations 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 otolaryngologist 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.
An analytic study of the audiometric and speech audiometric tests.

D. NEUROPATHOLOGIES OF SPEECH
Fall. 4(3-3)
Etiology, symptomatology, and therapeutic procedures for the speech and hearing disorders of those with speech and hearing impairment, with a focus on those related to brain damage-risk factors; including the development of hearing aids.

Spring. 4(4-0) Approval of department.
An analytic study of the audiometric and speech audiometric tests.

854. Psychophysics and Theories of Audition
Fall, Winter, Spring. 4(3-0)
Evaluative procedures including play audiometry, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; habilitative procedures for the acoustically handicapped child.

855. Psychophysiology and Theories of Audition
(554B) Summer. 4(3-0)
Evaluative procedures including play audiometry, language assessment, and case studies as aids to the differential diagnosis of auditory disorders in children; habilitative procedures for the acoustically handicapped child.

874. Speech and Hearing Problems in Public Schools
Fall, Winter, Spring. 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-Neuropsychology
Fall. 4(3-1) Approval of department.
A discussion of useful algorithms applicable to quantification of phenomena related to audiology and speech sciences.

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.
### BIOCHEMISTRY  BCH

**College of Agriculture and Natural Resources**

**College of Human Medicine**

**College of Natural Science**

**College of Osteopathic Medicine**

#### 200. Introduction to Biochemistry

- **Fall, 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.
- **Seminar techniques of wide application in biochemistry.**
- **A comprehensive presentation of biochemistry designed for undergraduate biochemistry majors, students of medicine, and other students desiring an intensive treatment of the subject.**

#### 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. 3(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(1-0) 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.**

### 432. 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. 3(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 term of general 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, Winter. Variable credit. May re-enroll for a maximum of 12 credits. Approval of department.**
- **Consideration of current problems.**

### Biological Science — Descriptions of Courses

#### 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, immunohistochemistry, hormones, control mechanisms and structure of biological macromolecules.**

#### 975. 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, 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, society 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(3-3) 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.