

**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**  
Spring. 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 858 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 magnetoionic 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.

†See page A-2, item 3.

**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. Introduction to Audiology**  
Fall, Spring. 5(4-1) 276, 277.

Fundamental aspects of normal hearing; hearing disorders, hearing tests.

**460. Aural Rehabilitation**  
Winter Summer. 5(4-1) 454 or approval of instructor.

Fundamental aspects of hearing aids, auditory training, and speechreading for the hearing-impaired person.

**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.

**Descriptions — Audiology and Speech Sciences  
of  
Courses**

**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**  
Fall. 4(3-0)

Longitudinal studies of stuttering theories and the therapies accompanying them.

**F. CLEFT PALATE**  
Summer. 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 Bekeesy, 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; habilitative 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.

**875A. Clinical Practicum in Speech and Language Pathology**

Fall, Winter, Spring, Summer. 1 credit. 474. May re-enroll for a maximum of 8 credits.

Directed diagnostic, therapeutic, and prognostic experience in speech and language pathology.

**875B. Clinical Practicum in Audiology**

Fall, Winter, Spring, Summer. 1 credit. 454. May re-enroll for a maximum of 8 credits.

Directed diagnostic, therapeutic and prognostic experience in audiology in various clinical settings.

**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. Medical Technology majors. Not acceptable for a B.S. degree in biochemistry. Others: approval of department. Quantitative clinical laboratory methods.

**400H. Honors Work**

Fall, Winter, Spring. Variable credit. Approval of department. Assigned reading and experimentation.

**401. Basic Biochemistry**

Fall, Spring. 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**

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.