207 The Science of Astronomy
Fall. 3(3-0) P: (PHY 231 or concurrently or PHY 231B or concurrently or ISP 205 or concurrently or PHY 181B or concurrently or PHY 183 or concurrently or PHY 183B or concurrently or LBS 271 or concurrently or PHY 231C or concurrently) and (MTH 116 or concurrently or MTH 114 or concurrently or LBS 117 or concurrently) Not open to students with credit in AST 201.
In-depth study of one topic in astronomy with emphasis on key discoveries. Topics may be cosmology, the solar system, and the life of stars. Observing with portable telescopes.

208 Planets and Telescopes
Spring. 3(2-2) P: (PHY 183 or PHY 183B or PHY 193H) and (MTH 132 or MTH 152H or LBS 118) RB: (AST 207) Not open to students with credit in AST 303.
Origin and nature of the solar system. Planets of the solar system and other star systems. Determination of time and celestial coordinates. Astronomical instruments and observational methods.

301 Junior Research Seminar
Fall, Spring. 1(1-0) P: Completion of Tier I writing requirement.
Preparation and presentation of a review paper on a current topic in astronomy or astrophysics.

303 Planetary System Astronomy
Fall of even years. 3(3-0) P: (PHY 183 or PHY 193H or PHY 183B) and (MTH 132 or MTH 152H or LBS 118) SA: AST 201
Origin and nature of the solar system. Planets of the solar system and other star systems. Asteroids, meteorites, and comets. Determination of time and celestial coordinates.

304 Stars
Fall of even years. 3(3-0) P: (AST 208) and (PHY 215) and (PHY 321 or concurrently) SA: AST 401
Physical processes that determine the structure and evolution of stars. Observations of stars and star clusters. Spectra of stars.

307 The Milky Way
Fall of odd years. 3(3-0) P: (PHY 183 or PHY 193H or PHY 183B) and (MTH 132 or MTH 152H or LBS 118) SA: AST 202
Structure and history of the Milky Way Galaxy. Stellar populations. Interstellar medium.

308 Galaxies and Cosmology
Spring of odd years. 3(3-0) P: (AST 208) and (PHY 215) and (PHY 321 or concurrently) SA: AST 402
The Milky Way. Structure and content of galaxies.
Active galaxies and quasars. The expanding universe. Modern cosmological models.

310 Directed Studies
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.
Individual study or project in astronomy or astrophysics under the direction of a faculty member.

312 Observational Astronomy
Spring. 1(0-2) P: (AST 303 or AST 307)
Basic observational techniques in astronomy. Stellar photometry and spectroscopy.

410 Senior Thesis
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P: (AST 301) and completion of Tier I writing requirement.
Design and execute an original experiment or computation. A written and oral report of the research is required.

800 Research Methods
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. RB: (AST 801)
Apprenticeship in astrophysical research. Student will work closely with faculty member to learn research techniques.

801 Introduction to Astrophysics
Fall. 3(3-0)
Survey of contemporary astrophysics. Stellar evolution, the structure of the Milky Way, the properties of external galaxies, and cosmology.

802 Techniques of Modern Astrophysics
Fall, Spring. 3 credits. RB: (AST 801)
Students are introduced to modern astrophysics through participation in short projects involving literature surveys, professional planning, and research in observational, theoretical, and computational astrophysics.

805 Research Project
Fall, Spring. 3(0-3) A student may earn a maximum of 6 credits in all enrollments for this course.
Research project to be completed under the guidance of an astronomy faculty member.

810 Radiation Astrophysics
Fall of odd years. 3(3-0)
Transfer of radiation through plasmas and processes for emission and absorption of photons. Interpretation of the spectra of stars, the interstellar medium, and galaxies.

820 Advanced Topics in Astrophysics
Fall, Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. RB: (AST 801)
Advanced work in a specialized astrophysical topic.

825 Galactic Astronomy
Spring of odd years. 3(3-0)
The Milky Way as a galaxy. Observations and techniques of theoretical analysis that are used to discover the features of our galaxy.

835 Extragalactic Astronomy
Fall of even years. 3(3-0)
Galaxies beyond the Milky Way. Large-scale structure of the universe. Cosmology.

840 Stellar Astrophysics
Spring of even years. 3(3-0)
Physics of stellar interiors. Methods for calculating stellar models. Principles of stellar evolution.

850 Electrodynamics of Plasmas
Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering; Physics. Administered by Department of Electrical and Computer Engineering. RB: (ECE 835 or PHY 488) SA: EE 850
Plasma kinetic and macroscopic plasma transport theory. Electromagnetic wave propagation and charged particle diffusion processes in plasma. Electromagnetic energy absorption via elastic and inelastic collisions. Dc, rf, and microwave discharges.

860 Gravitational Astrophysics
Fall. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. RB: (PHY 820 and PHY 841)
Experimental foundations, theory, and applications of gravitational physics and general relativity. Tests of the equivalence principle, modern solar system tests of general relativity, Schwarzschild metric, Hawking effect, Einstein's field equations.

861 Cosmology
Spring. 3(3-0) R: Open only to graduate students in the Department of Physics and Astronomy. SA: AST 860A
Current research in cosmology: observational basis for the Big Bang, the cosmic background radiation, primordial nucleosynthesis, content and distribution of matter, cosmic geometry, growth of perturbations.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open only to graduate students in Astronomy and Astrophysics.
MS Thesis Research

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 120 credits in all enrollments for this course. R: Open only to doctoral students in Astronomy and Astrophysics.
Doctoral dissertation research.

AUDIOLOGY AND SPEECH SCIENCES ASC

Department of Audiology and Speech Sciences
College of Communication Arts and Sciences

203 Introduction to Communication Sciences and Disorders
Fall, Spring. 3(3-0) Not open to students with credit in ASC 403.
Survey of research and practice regarding speech, hearing and language disorders in children and adults.

214 Anatomy and Physiology of the Speech and Hearing Mechanism
Fall. 4(3-2) P: (ASC 203 or concurrently)
Structural and functional analyses of the central and peripheral auditory mechanisms, and of the respiratory, phonatory, and articulatory mechanisms for speech.

232 Descriptive Phonetics
Fall, Spring. 2(1-2)
Principles of speech production. Transcription of speech using the International Phonetic Alphabet.

303 Hearing Science
Fall. 3(2-2) P: (MTH 106 or MTH 152H or MTH 110 or MTH 201 or MTH 116 or STT 200 or MTH 124 or STT 201 or MTH 132) RB: Completion of one ISP course. SA: ASC 255
Physical and psychological aspects of sound and their measurement. Emphasis on the understanding of human communication and its disorders.

313 Speech Science
Spring. 3(2-2) P: (ASC 214 and ASC 232 or concurrently) RB: Completion of one ISP course SA: ASC 255
Processes underlying the production and perception of speech. Understanding human communication and its disorders.

333 Oral Language Development
Fall, Spring. 3(3-0) P: (PSY 101 or LIN 200 or LIN 401 or ENG 302) R: Not open to freshmen.
Development of receptive and expressive aspects of child language.

344 Evaluation Procedures in Audiology
Spring. 4(3-2) P: (ASC 303) and completion of Tier I writing requirement.
Classification of hearing disorders. Behavioral and electrophysiological measurement of hearing, including subjective and objective testing procedures.

364 Evaluation Procedures in Speech-Language Pathology
Fall. 4(3-2) P: (ASC 313) and completion of Tier I writing requirement.
Evaluation procedures in speech-language pathology. Test procedures. Analysis of results. Report writing.

394 Observation and Analysis of Clinical Practice
Fall, Spring, Summer. 1(0-2) P: (ASC 344 and ASC 364)
Case presentations. Interviewing techniques. Behavioral observation and data collection. Behavior management. Counseling. Session plan and report writing.

403 Communication Sciences and Disorders
Fall. 3(3-0) R: Not open to freshmen or sophomores. Not open to students in the Department of Audiology and Speech Sciences. Not open to students with credit in ASC 203.
Research and practice regarding communication disorders and the professions of speech-language pathology and audiology.

433 Language Dialect Differences in Applied Contexts
Spring. 3(3-0) P: (ASC 333 or LIN 200 or LIN 401 or ENG 302)
Regional, ethnic, and cultural characteristics of American English. Comparison of speech-language differences and disorders.

443 Rehabilitative Audiology
Fall. 3(3-0) P: (ASC 344)
Fundamental aspects of auditory rehabilitation. Individual and group amplification systems, auditory training, speechreading, and counseling with children and adults.

463 Intervention Procedures in Speech-Language Pathology
Spring. 3(3-0) P: (ASC 364)
Intervention procedures for individuals with developmental and acquired communication disorders.

473 Phonological Disorders in Children
Spring. 3(3-0) P: (ASC 364)
Phonological theory, speech perception and production, nature of normal and abnormal phonological development. Preparation of assessment and treatment plans. Application of treatment principles to different populations and cultural groups. Practice with narrow phonetic transcription of speech and phonological process-analysis.

483 School-Based Communication Disorders Programs
Spring. 3(3-0) P: (ASC 463 or concurrently)
Administrative and regulatory aspects of school-based programs for persons with communication disorders.

490 Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department.
Individualized student activities in human communication sciences and disorders.

494 Clinical Practicum in Communication Disorders
Fall, Spring, Summer. 2(0-4) A student may earn a maximum of 4 credits in all enrollments for this course. P: (ASC394 and ASC463) RB: A minimum of 25 hours of approved clinical observation.
Supervised clinical experiences. Work with individuals having speech, language and/or hearing disorders.

803 Research Methods in Communication Sciences and Disorders
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.
Hypothesis generation, experimental design, data collection, data analysis and presentation.

813 Neuroanatomy and Neurophysiology of Speech, Language, and Hearing
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.
Structural and functional descriptions of the nervous system as it relates to communication sciences and disorders.

823A Acquired Language Disorders
Spring. 3(3-0) P:M: (ASC 813) R: Open only to graduate students in Audiology and Speech Sciences.
Neuropathology, symptomatology, and speech-language rehabilitation of individuals with aphasia and related disorders.

823B Motor Speech Disorders
Fall. 3(3-0) RB: (ASC 813 or concurrently) R: Open only to graduate students in Audiology and Speech Sciences.
Neuropathology, symptomatology, and speech-language habilitation and rehabilitation of individuals with motor speech disorders.

823C Voice Disorders
Spring. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.
Etiology, symptomatology, diagnosis, and treatment of voice disorders in children and adults.

823D Fluency Disorders
Fall. 3(3-0) R: Open only to graduate students in Audiology and Speech Sciences.
History, theories, symptomatology, diagnosis, and treatment of fluency disorders in children and adults.

823E Assessment of Childhood Language Disorders
Fall. 3(2-2) R: Open only to graduate students in the Department of Audiology and Speech Sciences.
Evaluation of language disorders of preschool, school-aged, and adolescent populations.

823F Language Intervention: Early Stages
Spring. 3(3-0) RB: (ASC 823E) or approval of department. R: Open only to graduate students in Audiology and Speech Sciences.
Principles of intervention in language disorders for children functioning at or below preschool levels, regardless of chronological age.

823G Language Intervention: Later Stages
Summer. 3(3-0) RB: (ASC 823E) or approval of department. R: Open only to graduate students in Audiology and Speech Sciences.
Principles of intervention in language disorders for school-age children and adolescents functioning above preschool levels.

823I Cognitive-Communicative Disorders
Spring. 3(3-0) P:M: (ASC 813 and ASC 823A and ASC 823B)
Neurophysiological, speech-language, cognitive, neuropsychological, and social/emotional rehabilitation associated with traumatic brain injury, dementia, and right hemisphere neurological disorders.

823J Medical Aspects of Speech-Language Pathology
Fall. 3(2-2) P:M: (ASC 813 and ASC 823C) C: ASC 823B concurrently.
Introduction to assessment, intervention, and management of persons with laryngectomy, tracheostomy, ventilator-dependence, and cleft lip and palate. Intensive study of the clinical procedures and instrumentation employed by speech-language pathologists who practice in medical settings.

823K Assessment and Treatment of Dysphagia
Summer. 3(3-0) P:M: (ASC 813) RB: (ASC 823A and ASC 823C)
Introduction to assessment, intervention, and management of persons with swallowing disorders.

823L Counseling in Communication Disorders
Summer. 3(3-0) P:M: (ASC 364 or ASC 344)
Overview of counseling issues related to communication disorders.

823X
Augmentative Communication
Spring. 3(3-0)
History and philosophy of augmentative communication. Assessment, system selection, and intervention considerations for aided and unaided systems. Synthesized voice output and micro-processor-based systems.

833 Auditory Psychophysics
Spring. 3(3-0) RB: (ASC 803)
Psychophysical theory and methods as applied to the study of hearing phenomena.

843A Diagnostic Audiology I
Fall. 3(3-0) RB: (ASC 344 and ASC 443) R: Open only to graduate students in Audiology and Speech Sciences.
Behavioral audiologic assessment of the peripheral and central auditory system.

843B Diagnostic Audiology II
Spring. 3(3-0) P:M: (ASC 843A)
Electrophysiologic audiologic assessment of the peripheral and central auditory system.

843C Hearing Amplification I
Fall. 3(3-0) P:M: (ASC843A or concurrently)
Historical and contemporary overview of personal amplification for individuals with hearing impairment. Theoretical and clinical strategies for evaluating and fitting contemporary hearing aids.

843E Pediatric Audiology
Summer. 3(3-0) P:M: (ASC 843A and ASC 843B)
Audiologic diagnostic procedures for the pediatric population. Includes the impact of disabilities other than hearing loss.

843F Advanced Rehabilitative Audiology
Fall. 3(2-2) P:M: (ASC 443) RB: (ASC 894A or ASC 894B) R: Open only to graduate students in Audiology and Speech Sciences.
Impact of hearing impairment on communication processes. History of and current practices in intervention for children and adults who have hearing impairment.

843G Medical Aspects of Audiology
Fall. 3(3-0) R: Open only to graduate students in the Department of Audiology and Speech Sciences.
Nature and bases of hearing impairment, and management principles from a medical perspective.

843I Hearing Amplification II
Spring. 3(3-0) P:M: (ASC 843C)
Advanced theoretical and clinical strategies for evaluating and fitting contemporary hearing aids. Assistive-listening devices, classroom amplification, hearing-aid dispensing, and contemporary clinical and research issues in amplification.

843J Manual Communication for Clinical Settings
Summer. 3(3-0) P:M: (ASC 344)
Introduction to the use of manually coded English sign systems and Pidgin Sign English in diagnostic and treatment sessions.

890 Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open only to M.A. students in Audiology and Speech Sciences. Approval of department.
Individualized study under faculty direction.

894A Clinical Practicum in Speech-Language Pathology
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department.
Supervised clinical experience in the management of clients with speech-language disorders.

894B Clinical Practicum in Audiology
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department.
Supervised clinical experience in the management of clients with hearing disorders.

899 Master's Thesis Research
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences. Approval of department.
Master's thesis research.

914A Speech Production
Spring of even years. 4(3-2)
Issues in speech production. Reference to human communication and its disorders.

914B Speech Perception
Spring of odd years. 4(3-2)
Issues in speech perception. Reference to human communication and its disorders.

990 Independent Study
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 16 credits in all enrollments for this course. R: Open only to Ph.D. students. Approval of department.
Individualized study under faculty direction.

991 Special Topics in Communication Sciences and Disorders
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences or approval of department.
Selected topics in human communication and its disorders.

992 Seminar in Communication Sciences and Disorders
Fall, Spring. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. R: Open only to graduate students in Audiology and Speech Sciences.
Topical themes in human communication and its disorders.

994 Research Practicum in Communication Sciences and Disorders
Fall, Spring, Summer. 1 credit. A student may earn a maximum of 12 credits in all enrollments for this course. RB: (ASC 803 or concurrently) R: Approval of department.
Individual research under faculty supervision.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to Ph.D. students in Audiology and Speech Sciences. Approval of department.
Doctoral dissertation research.

BIOCHEMISTRY AND MOLECULAR BIOLOGY BMB

Department of Biochemistry and Molecular Biology
College of Natural Science

100 Current Issues in Biochemistry
Spring. 1(1-0) R: Open only to freshmen or sophomores. SA: BCH 100 Not open to students with credit in BMB 101.
Contemporary biochemistry: its impact on environmental, medical, and social sciences.

101 Frontiers in Biochemistry
Fall. 1(1-0) R: Open only to freshmen or sophomores. SA: BCH 101 Not open to students with credit in BMB 100.
Description of topics in biochemistry research.

200 Introduction to Biochemistry
Fall. 4(4-0) P: (CEM 143) SA: BCH 200 Not open to students with credit in BMB 401 or BMB 461.
Basic structures of major classes of biologically important molecules and metabolic activities of major importance in living organisms.

401 Basic Biochemistry
Fall, Spring. 4(4-0) P: (CEM 252 or CEM 352) R: Not open to students in the Biochemistry or in the Biochemistry/Biotechnology major. SA: BCH 401 Not open to students with credit in BMB 200 or BMB 461.
Structure and function of major biomolecules, metabolism, and regulation. Examples emphasize the mammalian organism.

461 Biochemistry I
Fall. 3(4-0) P: (CEM 252 or CEM 352) and (BS 110) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 158H or LBS 159H) SA: BCH 461 Not open to students with credit in BMB 200 or BMB 401.
Protein structure and function, enzymology, bioenergetics, and intermediary metabolism.

462 Biochemistry II
Spring. 3(4-0) P: (BMB 461) SA: BCH 462
Continuation of BMB 461 with emphasis on metabolic regulation and nucleic acid structure, replication and protein synthesis.

471 Biochemistry Laboratory (W)
Spring. 3(0-9) P: (BMB 401 or BMB 461) and (BS 110 and CEM 262 and CEM 356 and CSE 101) and (MTH 124 or MTH 132 or MTH 152H or LBS 118) and (BS 111L or LBS 145 or LBS 158H or LBS 159H) and completion of Tier I writing requirement. SA: BCH 471
Biochemical methods and principles used in the study of enzymes (proteins), carbohydrates, lipids, and cell organelles.

472 Biochemistry Laboratory
Fall. 3(0-9) P: (BMB 462 and CEM 262) R: Open only to Biochemistry or Biochemistry/Biotechnology majors or approval of department. SA: BCH 472
Methods of molecular biology and the underlying principles on which these methods are based.