**Applied Cognition and Neuroscience**

**ACN 5314 (HCS 5314)** Computational Modeling Methods in Behavioral and Brain Sciences (3 semester credit hours) Computational Neuroscience, Cognitive Neural Modeling, Machine Learning, and Mathematical Psychology modeling methodologies are introduced through the use of computer-based simulation modeling experiments. Emphasizes creative applications of these research methodologies. Prerequisites: BBSC majors only and department consent required. (3-0) T

**ACN 6110 (HCS 6110)** Fundamentals of Functional Brain Imaging Lab (1 semester credit hour) This course covers applications of functional neuroimaging data collection and analysis methods focusing on methods of data collection, and experimental design, data analysis methods, and how they are related. Students work in the lab to develop proficiency with neuroimaging analysis software tools. Class meetings will consist of lectures, hands-on demonstrations, and work-through sessions with readily available data sets to learn the mechanics of basic fMRI data analysis. Corequisite: ACN 6310 or HCS 6310. Prerequisites: BBSC majors only and department consent required. (0-3) Y

**ACN 6160** Neurobiology (1 semester credit hour) A self-paced course providing the neurobiological foundation for the study of speech-language pathology. Pass/Fail only. This course is offered in an online format only. Prerequisites: COMD majors only and department consent required. (1-0) S

**ACN 6310 (HCS 6310)** Fundamentals of Functional Brain Imaging (3 semester credit hours) In-depth topics in brain imaging including neuroimaging detection systems (primarily MRI), experimental design, statistical techniques in image analysis, clinical applications of functional neuroimaging, and reviews of pertinent literature using functional brain imaging to illuminate various cognitive and perceptual processes, including language, memory, hearing, and vision. Corequisite: ACN 6110 or HCS 6110. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6312 (HCS 6312 and PSYC 6312)** Research Methods in Behavioral and Brain Sciences - Part I (3 semester credit hours) This course focuses on applying, understanding, and interpreting various ANOVA-related statistical techniques in a behavioral science context. Students learn the frameworks for hypothesis testing and effect size estimation. The course provides students with an understanding of the interrelationships among statistical techniques, and computer skills required for data analyses. Students without the necessary background knowledge of basic statistics and experimental design will be required to take PSY 3392 before registering for ACN 6312. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6313 (HCS 6313 and PSYC 6313)** Research Methods in Behavioral and Brain Sciences - Part II (3 semester credit hours) This course focuses on applying, understanding, and interpreting regression and analysis of variance-related statistical techniques in a behavioral and brain science context. The course provides students with increased conceptual understanding of topics within regression and analysis of variance (e.g., hierarchical regression analysis, multiple regression with continuous and categorical predictors, regression diagnostics, fixed, random, and mixed effect models), along with computer skills required to interpret data analyses. Prerequisites: (ACN 6312 or HCS 6312 or PSYC 6312) and department consent required. (3-0) Y

**ACN 6316 (HCS 6316 and PSYC 6316)** Research Methods in Behavioral and Brain Sciences - Part III (3 semester credit hours) Applying, understanding, and interpreting various advanced multivariate statistical techniques in brain and behavioral science contexts. Includes principal component analyses, simple and multiple correspondence analyses, partial least square
methods, multi-table analyses, discriminant analyses, cluster analysis, and structural equation modeling. May be repeated for credit as topics vary (6 semester credit hours maximum).

**Prerequisite:** BBSC majors only. (3-0) R

**ACN 6322 (HCS 6322)** Computational Modeling Methods for Language Understanding (3 semester credit hours) Probabilistic methods for modeling natural language understanding and the statistical analysis of language data. Use of the MATLAB and PERL computer languages for instantiating specific knowledge-based computational theories of natural language understanding with a focus on information retrieval and text mining methods. Emphasizes creative applications of these research methodologies. Prerequisites: BBSC majors only and department consent required. (3-0) R

**ACN 6330 (HCS 6330 and PSYC 6330)** Cognitive Science (3 semester credit hours) Cognitive, computational, and neural processing approaches to understanding perception, memory, thought, language, and emotion. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6331 (HCS 6331 and PSYC 6331)** Cognitive Development (3 semester credit hours) Survey of cognitive development theories and research in a variety of domains including perception, memory, language, and problem solving. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6332 (HCS 6332 and PSYC 6332)** Perception (3 semester credit hours) Psychophysical, neurophysiological, and computational foundations of sensation and perception. Basic senses of vision, audition, chemoreception, and tactile processing, with emphasis on understanding the processes that take us from neurons to perception and action. (3-0) R

**ACN 6333 (HCS 6333 and PSYC 6333)** Memory (3 semester credit hours) Research and theory on the acquisition, representation, and retrieval of information by the mind/brain. Includes information processing and neuropsychological perspectives. Prerequisites: BBSC majors only and department consent required. (3-0) R

**ACN 6334 (HCS 6334)** Attention (3 semester credit hours) Theory and evidence on the study of attention especially in human vision and audition. Includes perceptual learning, information processing, and neuropsychological approaches. (3-0) R

**ACN 6337** Cognitive Ethnography (3 semester credit hours) Students in this course will learn to observe, document, and analyze cognitive processes in real-world settings using the methods of cognitive ethnography. The course provides students with an understanding of the embodied, situated, and distributed cognition and the interaction of cognition and culture that forms the foundation of cognitive ethnography methodology. The course may emphasize the uses of cognitive ethnography in human-computer interaction, system design, laboratory studies, cultural psychology, or media effects. Department consent required. (3-0) R

**ACN 6338 (HCS 6338 and PSYC 6338)** Functional Neuroanatomy (3 semester credit hours) An introduction to human neuroanatomy organized by major brain system. Function of the neuroanatomy of each major system and relation to neurological disorders associated with damage to the neuroanatomy of the system. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6340 (HCS 6340)** Cellular Neuroscience (3 semester credit hours) Basic neural biology and physiology and principles of synaptic transmission. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6341** Human Computer Interactions I (3 semester credit hours) Methods and principles of human-computer interaction (HCI), user-centered design (UCD), and use ability evaluation. Provides broad overview of HCI and how HCI informs UCD processes throughout product development life cycle. Department consent required. (3-0) Y

**ACN 6342** Human Computer Interactions II (3 semester credit hours) Detailed exploration of human-computer interaction (HCI) through readings in journal articles and research reports.
Practical experience in methodology typically used in the design of usable systems. Department consent required. (3-0) Y

**ACN 6346 (HCS 6346) and PSYC 6346** Systems Neuroscience (3 semester credit hours) Integrative systems level study of the nervous system. Aspects of neural mechanisms and circuitry underlying regulation of motor behaviors, sensory and perceptual processing, biological homeostasis, and higher cognitive functions. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6348 (HCS 6348)** Neural Net Mathematics (3 semester credit hours) Introduction to a large class of statistical machine learning algorithms including unsupervised, supervised, and reinforcement learning machines. Vector calculus and vector calculus-based probability theory with machine learning and artificial neural network modeling applications. Stochastic sequences of mixed random vectors, Bayesian Networks, and Markov random fields. Emphasizes applications of the theory to unsupervised, supervised, and reinforcement learning machines and artificial neural network modeling. Provides required math background for **ACN 6349** or **HCS 6349**. Prerequisites: (Linear algebra and multivariable calculus and **STAT 3341** or equivalent) and BBSC majors only and department consent required. (3-0) T

**ACN 6349 (HCS 6349)** Statistical Machine Learning for Artificial Neural Nets (3 semester credit hours) Mathematical tools for investigating the asymptotic behavior of both batch and adaptive machine learning algorithms including the Invariant Set Theorem, Zoutendijk-Wolfe convergence theorem, adaptive stochastic approximation methods, and Monte Carlo Markov Chain methods. M-estimation and bootstrap asymptotic statistical theory for characterizing asymptotic behavior of parameter estimates as a function of sample size to support: model selection, specification analysis, and hypothesis testing. Emphasizes applications of the theory to unsupervised, supervised, and reinforcement learning machines and artificial neural network modeling. Prerequisites: (**ACN 6348** or **HCS 6348**) and BBSC majors only and department consent required. (3-0) T

**ACN 6363 (HCS 6363)** Text Comprehension Seminar (3 semester credit hours) Current readings in the field of text comprehension and memory. May be repeated for credit as topics vary (6 semester credit hours maximum). Prerequisites: BBSC majors only and instructor consent required. (3-0) R

**ACN 6367 (HCS 6367) and PSYC 6367** Speech Perception (3 semester credit hours) Current topics and theories in speech perception. Topics include the acoustic correlates of speech sounds and the problem of invariance, the perception of speech under adverse conditions, the effects of hearing impairment, and models of speech perception. Prerequisites: BBSC majors only and department consent required. (3-0) R

**ACN 6368 (HCS 6368) and PSYC 6368** Language Development (3 semester credit hours) Advanced study of normal oral language development. The goals of this course are to consider the developmental trajectories of the different components of language; to consider the varied and critical roles of language in human development; to understand the impact of culture, different languages, child factors and the environment on development; and to be introduced to the theoretical perspectives driving research and thinking in this area of inquiry. Prerequisite: BBSC majors only. (3-0) Y

**ACN 6372 (HCS 6372)** The Neuroscience of Pain (3 semester credit hours) A systems-oriented course covering the anatomical and physiologic basis of pain. The course describes the basic features of neural processing of pain signals in the spinal cord and brain, the anatomy and the function of the descending systems that can control transmission of pain signals, and peripheral and central sensitization. The physiological and molecular basis for treatment of pain is discussed. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6373 (HCS 6373)** Intraoperative Neurophysiological Monitoring (IONM) Part I (3 semester credit hours) Part 1 of the course covers the anatomical and physiological basis for the use of
electrophysiological techniques in the surgical operating room and clinically in diagnosis of disorders affecting the nervous system. Prerequisite: BBSC majors only. (3-0) Y

ACN 6374 (HCS 6374) Intraoperative Neurophysiological Monitoring (IONM) Part II (3 semester credit hours) Part II covers the use of recordings of neuro-electric brain potentials and their interpretation during surgical operations and clinically for diagnostic purposes. The use of electrophysiological methods for guiding implantation of stimulating electrodes deep in the brain and for assisting the surgeon in certain operations are also described. Prerequisite: ACN 6373 or HCS 6373. (3-0) Y

ACN 6388 (HCS 6388) MATLAB for Brain Sciences (3 semester credit hours) Introduction to MATLAB computer programming. Covers the use of the MATLAB programming language for the purpose of stimulus generation, behavioral data analysis, statistical analyses, and generation of publication quality figures. Prerequisites: BBSC majors only and department consent required. (3-0) R

ACN 6389 (HCS 6389) Speech Perception Laboratory (3 semester credit hours) Introduction to the field of speech processing by computer, with primary application to research techniques in the study of speech perception. Prerequisites: BBSC majors only and department consent required. (0-9) T

ACN 6395 (HCS 6395 and PSYC 6395) Cognitive Psychology (3 semester credit hours) Theory and research on perception, learning, thinking, psycholinguistics, and memory. Prerequisites: BBSC majors only and department consent required. (3-0) Y

ACN 6V71 Industry Internship (1-6 semester credit hours) Pass/Fail only. May be repeated for credit (12 semester credit hours maximum). Prerequisites: BBSC majors only and department consent required. ([1-6]-0) S

ACN 6V72 Research Internship (1-6 semester credit hours) Pass/Fail only. May be repeated for credit (12 semester credit hours maximum). Prerequisites: BBSC majors only and instructor consent required. ([1-6]-0) S

ACN 6V81 Special Topics in Applied Cognition and Neuroscience (1-9 semester credit hours) May be repeated for credit as topics vary (12 semester credit hours maximum). Prerequisites: BBSC majors only and department consent required. ([1-9]-0) Y

ACN 7310 (HCS 7310) Advanced Research Methods (3 semester credit hours) Advanced methods of inquiry and analysis unique to cognition and neuroscience, communication sciences and disorders, or psychological sciences. May be repeated for credit as topics vary (12 semester credit hours maximum). Prerequisites: HCS 6313 and department consent required. (3-0) Y

ACN 7320 (HCS 7320) Topics in Multivariate Data Analysis using R (3 semester credit hours) R programming language (including writing functions and using special packages). Using the R programming language to analyze standard designs used in Behavioral and Brain Science. Includes designing publication ready graphics and analysis of experimental data and surveys. May be repeated for credit as topics vary (9 semester credit hours maximum). Prerequisite: ACN 6313 or HCS 6313 or PSYC 6313 or instructor consent required. Corequisite: ACN 7321. (3-0) Y

ACN 7321 (HCS 7321) Topics in Multivariate Data Analysis Theory (3 semester credit hours) Principal component analysis, correspondence analysis, multidimensional scaling, discriminant analysis, partial least square methods, multi-table analysis, cluster analysis, and various other statistical techniques. Includes discussion of computationally intensive cross-validation inference methods such as jackknife and bootstrap. May be repeated for credit as topics vary (9 semester credit hours maximum). Prerequisite: ACN 6313 or HCS 6313 or PSYC 6313 or instructor consent required. Corequisite: ACN 7320. (3-0) Y

ACN 7324 (AUD 7324 and COMD 7324) Seminar in Cochlear Implants and Technology for Persons with Hearing Impairments (3 semester credit hours) This course provides an overview of prosthetic alternatives to conventional amplification for individuals with significant hearing
loss. Topics include candidacy determination, technology, basics of device programming and troubleshooting, awareness of controversial areas related to cochlear implantation, and future trends in cochlear implantation. Further, this course will cover current issues in the medical, audiological, speech/language, quality of life, and educational management of children and adults with cochlear implants. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 7330 (HCS 7330)** Advanced Functional Brain Imaging (3 semester credit hours) This course explores more in-depth topics such as neuroimaging detection systems, clinical applications of functional neuroimaging, experimental design, statistical techniques in image analysis and reviews of pertinent literature using functional brain imaging to illuminate various cognitive and perceptual processes, such as language, memory, hearing and vision. Prerequisites: BBSC majors only and department consent required. (3-0) R

**ACN 7338 (HCS 7338)** Brain Connectivity (3 semester credit hours) Systems and cognitive neuroscience based approach towards measuring and understanding patterns of brain connectivity in humans and non-human animals. Prerequisites: (HCS 6346 or HCS 6338) and instructor consent required. (3-0) R

**ACN 7343 (HCS 7343)** Neuropharmacology (3 semester credit hours) Biology of neurotransmission in the central nervous system. Includes ionotropic and metabotropic coupling of all known classes of receptors to both their cellular and systemic effects. Clinical efficacy, side effects, and other issues related to drug use and abuse are covered. Prerequisites: (ACN 6340 or HCS 6340 or ACN 6346 or HCS 6346 or PSYC 6346) and department consent required. (3-0) T

**ACN 7372 (HCS 7372)** Seminar in Neuroscience (3 semester credit hours) Selected topics and current research in neuroscience. May be repeated for credit as topics vary (12 semester credit hours maximum). Prerequisite: BBSC majors only. (3-0) Y