Applied Cognition and Neuroscience

**ACN 5314 (HCS 5314)** Computational Modeling Methods in Behavioral and Brain Sciences (3 semester credit hours) Historical introduction to machine learning algorithms from a cognitive-neuroscience perspective. Includes an introduction to important and widely used computational modeling methodologies in psychology, neuroscience, and machine learning. No mathematical prerequisites and no computer programming prerequisites, but students will use the computer in simulation experiments. 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: Speech-Language Pathology M.S. students 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 6323 (HCS 6323) Neurophysiology (3 semester credit hours)** This course focuses on the elements of neural functions ranging from the kinetics of channels in excitable membranes to the collective behavior of real neural networks. Prerequisites: (ACN 6340 or HCS 6340) and department consent required. (3-0) Y

**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 language, memory, social cognition, and learning. 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, neuropsychological and cognitive neuroscience 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 consideration of automatic and controlled processes, the time course of perceptual processing, and the role of working memory. (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)** A detailed study of neural physiology and the principles of synaptic transmission. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**ACN 6341 Foundations of Human-Computer Interaction (3 semester credit hours)** Principles of human factors and technology trends within human-computer interaction (HCI). Discussions of the relevance of cognitive science methodologies and findings. Exploration of HCI research and practice through readings in journal articles and research reports. Department consent required. (3-0) Y

**ACN 6342 Applied Human-Computer Interaction (3 semester credit hours)** Broad overview of how human-computer interaction (HCI) informs the user-centered design (UCD) process. Practical experience in the core methods of user experience (UX) design and research throughout the product development lifecycle.
Department consent required. (3-0) Y

**ACN 6344**  Human-Computer Interaction Lab (3 semester credit hours) Exploration of advanced topics in human-computer interaction (HCI) in both research and industry. Practical experience with latent methods used in user experience design and research that build upon core methods introduced in **ACN 6342**. Prerequisite: **ACN 6342** or instructor consent required. (3-0) Y

**ACN 6345** (HCS 6343) Neurobiology of Learning and Memory (3 semester credit hours) Current research and theory on modifications in the central nervous system that contribute to the processes of learning and memory. Includes an overview of different forms of learning as assessed in model systems, with reviews of anatomical, cellular, and molecular changes underlying neuronal and behavioral plasticity. Prerequisites: **ACN 6346** or **HCS 6346** or **PSYC 6346** and 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) Vector calculus, Radon-Nikodym density functions, vector calculus-based probability theory, Markov chains, and Markov random fields with machine learning and artificial neural network modeling applications. Emphasizes applications of theory to unsupervised, supervised, and reinforcement learning machines and deep learning. This course is a required prerequisite for **ACN 6349** and **HCS 6349**. Prerequisites: Linear algebra and calculus and (**STAT 3341** or equivalent) and department consent required. (3-0) T

**ACN 6349** (HCS 6349) Statistical Machine Learning (3 semester credit hours) Mathematical tools for investigating the asymptotic behavior of both batch and adaptive machine learning algorithms including the 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 theory to unsupervised, supervised, and reinforcement learning machines and deep learning. Prerequisites: (**ACN 6348** or **HCS 6348**) 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** 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)
Covers the anatomical and physiological basis for the use of electrophysiological techniques in the surgical operating room, modalities that are utilized, and surgical procedures that are monitored. Prerequisite: BBSC majors only. (3-0) Y

**ACN 6374 (HCS 6374)** Intraoperative Neurophysiological Monitoring (IONM) Part II (3 semester credit hours)
Covers recordings of neuro-electric brain potentials and their interpretation during high-risk surgical procedures and clinically for diagnostic and therapeutic purposes. The use of various neurophysiological methods for guiding implantation of stimulating electrodes deep in the brain and for assisting the surgeon in certain operations are also described. This course will cover an understanding of the various IONM techniques for different surgical procedures, including the brain, spine, and peripheral nerve surgeries. Students will be exposed to the basics and advance knowledge of neurophysiological monitoring techniques. IONM Part II, focusing on the national professional competencies, professional standards of practice, and evidence-based theory, is presented. The students will also learn to utilize research skills to explore the latest protocols and standards of practice. This course is second in two-part sequence to prepare the students for the Certification in Intraoperative Neurophysiological Monitoring (CNIM) examination administered by ABRET. IONM Part II is a very interactive course, and the students are expected and encouraged to participate in class discussions. Prerequisite: **ACN 6373** or **HCS 6373**. (3-0) Y

**ACN 6375 (HCS 6375)** IONM Special Topics (3 semester credit hours) Special topics in the area of Intraoperative Neurophysiological Monitoring (IONM). May be repeated for credit as topics vary. Prerequisites: (**ACN 6373** or **HCS 6373** or **ACN 6374** or **HCS 6374** or instructor consent) and BBSC majors only. (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. No computer programming prerequisites but students will learn MATLAB programming. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**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. Lab fee of $30 required. 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)

**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). Prerequisite: **ACN 6313** or **HCS 6313** or **PSYC 6313** or instructor 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 Who are Deaf or Hard of Hearing (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. This course also has a complementary laboratory course. Prerequisites: BBSC majors only and department consent required. (3-0) Y

**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