

APPENDIX A
COGNITIVE AND BRAIN SCIENCES
GRADUATE INTERDISCIPLINARY SPECIALIZATION PROPOSAL
CENTER FOR COGNITIVE AND BRAIN SCIENCES
REQUIRED AND ELECTIVE COURSE DESCRIPTIONS

| | COURSE | DESCRIPTION | CREDIT HOURS |
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| INTRODUCTORY COURSE <hr/> CHOOSE 1 COURSE | CSE 5531 or LING 5612 or PHILOS 5830 or PSYCH 5612: <i>Introduction to Cognitive Science</i> | Cognitive science is an interdisciplinary study of the nature of human thought; psychological, philosophical, linguistic, and artificial intelligence approaches to knowledge representation. | 3 |
| | PSYCH 5614: <i>Cognitive Neuroscience</i> | Neuronal mechanisms of information processing. | 3 |

| | COURSE | DESCRIPTION | CREDIT HOURS |
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| PROSEMINAR <hr/> REQUIRED | CSE 5891 or LING 5891 or PHILOS 5891 or PSYCH 5891 or SPHRNG 5891: <i>Proseminar in Cognitive Science</i> | Provides an in-depth examination of cognitive science from an interdisciplinary perspective. | 2 |

| ELECTIVES | COURSE | DESCRIPTION | CREDIT HOURS |
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| ELECTIVE COURSES <hr/> CHOOSE 2 COURSES | CSE 4521: <i>Survey of Artificial Intelligence for Non-Majors</i> | Survey of the basic concepts and techniques in artificial intelligence, including problem solving, knowledge representation, and machine learning. | 3 |
| | CSE 5521: <i>Survey of Artificial Intelligence I: Basic Techniques</i> | Survey of the basic concepts and techniques in artificial intelligence, including problem solving, knowledge representation, and machine learning. | 2 |
| | CSE 5522: <i>Survey of Artificial Intelligence II: Advanced Techniques</i> | Survey of advanced concepts, techniques, and applications of artificial intelligence, including knowledge representation, learning, natural language understanding, and vision. | 3 |

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| <p><i>ELECTIVE COURSES CONTINUED</i></p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>CSE 5523: <i>Machine Learning and Statistical Pattern Recognition</i></p> | <p>Introduction to basic concepts of machine learning and statistical pattern recognition; techniques for classification, clustering and data representation and their theoretical analysis.</p> | 3 |
| | <p>CSE 5524: <i>Computer Vision for Human-Computer Interaction</i></p> | <p>Computer vision algorithms for use in human-computer interactive systems; image formation, image features, segmentation, shape analysis, object tracking, motion calculation, and applications.</p> | 3 |
| | <p>CSE 5525: <i>Foundations of Speech and Language Processing</i></p> | <p>Fundamentals of natural language processing, automatic speech recognition and speech synthesis; lab projects concentrating on building systems to process written and/or spoken language.</p> | 3 |
| | <p>CSE 5526: <i>Introduction to Neural Networks</i></p> | <p>Survey of fundamental methods and techniques of neural networks; single- and multi-layer perceptrons; radial-basis function networks; support vector machines; recurrent networks; supervised and unsupervised learning.</p> | 3 |
| | <p>CSE 5539: <i>Intermediate Studies in Artificial Intelligence</i></p> | <p>Intermediate-level topics in artificial intelligence.</p> | 2 |
| | <p>ECE 5200: <i>Introduction to Digital Signal Processing</i></p> | <p>Sampling and reconstruction; discrete-time rate conversion; processing of discrete-time signals; design of discrete-time filters, selected topics in adaptive and/or multidimensional signal processing.</p> | 3 |
| | <p>ECE 5206: <i>Medical Imaging and Processing</i></p> | <p>Introduction to medical imaging techniques (CT, MRI, PET, ultrasound), including data collection, image reconstruction, physics of tissue interactions, and digital processing of medical images.</p> | 3 |

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| <p><i>ELECTIVE COURSES CONTINUED</i></p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>ECE 5460: <i>Image Processing</i></p> | <p>Fundamentals and research directions in image processing: cameras, geometry, calibration, 2D and 3D image reconstruction, stereo, structure from motion, Radiometry, filtering, motion estimation, and applications.</p> | 3 |
| | <p>ECE 5759: <i>Optimization for Static and Dynamic Systems</i></p> | <p>Numerical optimization techniques as applied to selected electrical engineering application areas.</p> | 3 |
| | <p>ECE 6001: <i>Probability and Random Variables</i></p> | <p>Probability, random variables, and random vectors for analysis and research in electrical engineering. Distribution functions, characteristic functions, functions of random variables and vectors, Markov chains.</p> | 3 |
| | <p>ECE 7866: <i>Computer Vision</i></p> | <p>Computer vision systems, image models, feature extraction, shape representation and recognition, object modeling and recognition, matching, probabilistic and statistical modeling, semantic knowledge, and face perception.</p> | 3 |
| | <p>ECE 7868: <i>Pattern Recognition and Machine Learning</i></p> | <p>Fundamentals of pattern recognition techniques and their application to computer and electrical engineering problems, medicine, cognitive science, and bioinformatics.</p> | 3 |
| | <p>ISE 5700: <i>Introduction to Cognitive Systems Engineering</i></p> | <p>Human-centered design of consumer products, web sites and complex sociotechnical systems. Topics include human-computer interaction and the design of decision support and distributed work systems.</p> | 3 |
| | <p>ISE 5705: <i>Cognitive Engineering Systems: Distributed and Cooperative Work</i></p> | <p>Provides key concepts for the design and assessment of computer supported collaborative and distributed work systems.</p> | 3 |

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| <p>ELECTIVE COURSES CONTINUED</p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>ISE 5710: <i>Behind Human Error: Safety and Complex Systems</i></p> | <p>Covers how complex systems fail and the human contribution to success and failure by studying actual disasters in diverse fields.</p> | 3 |
| | <p>ISE 5720: <i>Human Systems Integration</i></p> | <p>Concepts and methods for considering the human as part of the design and operation of any system, especially large scale systems and enterprises.</p> | 3 |
| | <p>ISE 5730: <i>Information Analysis and Synthesis</i></p> | <p>Professional information analysis in engineering, intelligence/security, business, and health care that identifies the factors that make the analytical process shallow or rigorous.</p> | 3 |
| | <p>ISE 5740: <i>Cognitive Engineering Systems: Human-Centered Automation</i></p> | <p>Provides key concepts to make autonomous systems, robots, and artificially intelligent systems team players with responsible people.</p> | 3 |
| | <p>ISE 5760: <i>Cognitive Engineering Systems: Visualization and Human-Computer Interfaces</i></p> | <p>Visualization and interface design principles and techniques to overcome data overload and aid sense making and other aspects of cognitive work.</p> | 3 |
| | <p>ISE 5770: <i>Cognitive Engineering Systems: Design and Evaluation</i></p> | <p>Evaluation of product and system design to assess usefulness and usability; advanced design concepts for consumer products, web sites, educational tools and information retrieval systems.</p> | 3 |
| | <p>ISE 7700: <i>Cognitive Systems Engineering: Advanced Topics</i></p> | <p>Seminar on emerging themes about human-machine systems and how these relate to current societal issues.</p> | 3 |
| | <p>LING 5001: <i>Formal Foundations of Linguistics</i></p> | <p>Applying tools from set theory, symbolic logic, model theory, algebra and formal grammar in the foundations of formal linguistic theories and in linguistic analysis.</p> | 3 |

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| ELECTIVE COURSES CONTINUED <hr style="width: 100%;"/> CHOOSE 2 COURSES | LING 5002: <i>Algebraic Linguistics</i> | Formal properties of grammar and automata; relations between linear, context-free and context-sensitive grammars and finite, pushdown-storage and linear-bounded automata; properties of transformational grammars. | 3 |
| | LING 5051: <i>Quantitative Methods in Linguistics</i> | Quantitative methods in the sub-disciplines of Linguistics, including data analysis, interpretation and display of data, inferential statistics, and statistical modeling. | 3 |
| | LING 5101: <i>Phonetics: Phonetic Theory</i> | Principles of articulatory phonetics, with some discussion of acoustic phonetics; practice in the production, recognition, and transcription of sounds in various languages of the world. | 3 |
| | LING 5102: <i>Laboratory Phonology</i> | Introduction to laboratory methods and quantitative models of speech for linguistics. | 3 |
| | LING 5201: <i>Syntactic Theory I</i> | Theories of syntax; principles of syntactic description. | 3 |
| | LING 5202: <i>Syntactic Theory II</i> | Theories of syntax; principles of syntactic description. | 3 |
| | LING 5203: <i>Syntactic Theory III</i> | Theories of syntax; principles of syntactic description. | 3 |
| | LING 5301: <i>Phonological Theory I</i> | Introduction to phonological analysis and the principles governing the structure, acquisition, and change of phonological systems; survey of major phonological theories. | 3 |
| | LING 5302: <i>Topics in Advanced Phonology</i> | Introduction to phonological analysis and the principles governing the structure, acquisition, and change of phonological systems; survey of major phonological theories. | 3 |
| | LING 5351: <i>Morphological Theory</i> | Introduction to and comparison of current theories of morphology with application to linguistic data and problems. | 3 |

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| ELECTIVE COURSES CONTINUED <hr style="width: 100%; border: 0.5px solid red;"/> CHOOSE 2 COURSES | LING 5401: <i>Semantic Theory I</i> | Problems and methods in linguistic semantics, using logic and semantic model theory as analytic tools; reference, compositionality, presupposition, conversational implicature, speech acts, deixis. | 3 |
| | LING 5402: <i>Semantic Theory II</i> | Montague semantics and more recent semantic theories; analysis of important problems, such as generalized quantifiers, lattice-based accounts of plurals and events, discourse representation theory. | 3 |
| | LING 5451: <i>Formal Pragmatics</i> | Introduction to contemporary theories of pragmatic phenomena which build on theories of dynamic interpretation in formal semantics. | 3 |
| | LING 5701: <i>Psycholinguistics I</i> | An introduction to high-level language processing, word recognition, sentence understanding, and discourse processing. | 3 |
| | LING 5702: <i>Psycholinguistics II</i> | Models of human language processing and language parsing and interpretation; probabilistic models, issues in experimentation, and model implementation. | 3 |
| | LING 5801: <i>Computational Linguistics I</i> | Symbolic and probabilistic computation applied to the structure of words and sentences, models of syntax, parsing algorithms. | 3 |
| | LING 5802: <i>Computational Linguistics II</i> | Computational models of language acquisition and application of machine learning techniques to language processing. | 3 |
| | LING 5803: <i>Computational Semantics</i> | Methods for construction semantic representations for fragments of natural language and performing inference with such representations. | 3 |
| | LING 8100: <i>Seminar in Phonetics</i> | Study of specific problems in articulatory and acoustic phonetics at an advanced level. | 3 |

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| ELECTIVE COURSES CONTINUED <hr/> CHOOSE 2 COURSES | LING 8200: <i>Seminar in Syntax</i> | Advanced topics in syntactic analysis. | 3 |
| | LING 8300: <i>Seminar in Phonology</i> | Advanced topics in phonological analysis. | 3 |
| | LING 8350: <i>Seminar in Morphology</i> | Advanced topics in morphological analysis. | 1-3 |
| | LING 8400: <i>Seminar in Semantics</i> | Accounts of semantic judgments in languages, especially within the theory of generative grammar; relationships between syntax, semantics, and language use. | 3 |
| | LING 8450: <i>Seminar in Pragmatics</i> | An intensive examination of one or more major problems in pragmatics, such as speech acts, implicature, or presupposition. | 3 |
| | LING 8700: <i>Seminar in Psycholinguistics</i> | Advanced topics in psycholinguistics. | 1-3 |
| | LING 8800: <i>Seminar in Computational Linguistics</i> | Advanced topics in computational linguistics. | 1-3 |
| | MUSIC 7785: <i>Cognitive Ethnomusicology</i> | Topics and issues in historical musicology and ethnomusicology. | 3 |
| | MUSIC 8824.01: <i>Computational Musicology I</i> | The use of computers in music research and instruction; music data structures and programming routines for music research and instruction. | 3 |
| | MUSIC 8824.02: <i>Computational Musicology II</i> | The use of computers in music research and instruction; music data structures and programming routines for music research and instruction. | 3 |
| | MUSIC 8838.01: <i>Topics in Music Cognition</i> | Critical survey of perceptual, cognitive, affective or neuroscience research related to music. | 3 |
| | MUSIC 8838.03: <i>Music and Emotion</i> | Examination of modern ideas related to music and affect. | 3 |
| | MUSIC 8838.04: <i>Topics in Recent Literature of Music Cognition</i> | Critical readings and discussion of current research publications in music cognition. | 3 |
| | MUSIC 8839.01: <i>Music Cognition Research Laboratory</i> | Practical experiences in laboratory studies of music. | 3 |

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| ELECTIVE COURSES CONTINUED | NEUROSC 7001: <i>Foundations of Neuroscience 1</i> | Discusses basic principles of the cellular, molecular and neurophysiological, and neuropharmacological organization of the nervous system. | 6 | |
| | NEUROSC 7002: <i>Foundations of Neuroscience 2</i> | Discusses the organization of select systems in the nervous system including motor, sensory, autonomic, and higher cognitive centers. Course will cover anatomical, functional and behavioral concepts. | 6 | |
| | NEUROSC 7050: <i>Neurobiology of Disease</i> | Neurobiology of Disease will explore the basis of major diseases affecting the nervous system. | 3 | |
| | PHILOS 5510: <i>Nonclassical Logic</i> | Study of selected systems of nonclassical logic, such as entailment systems, modal, many-valued, epistemic deontic, imperative, erotetic, tense and free logics. | 3 | |
| | CHOOSE 2 COURSES | PHILOS 5520: <i>Inductive Logic and Probability Theory</i> | An analysis of selected systems of inductive inference; the probability calculus and its interpretations; confirmation theory. | 3 |
| | PHILOS 5530: <i>Philosophy of Logic and Mathematics</i> | Analysis of basic concepts used in logic and in philosophical claims about logic and mathematics, such as proposition, logical truth, mathematical objects, and necessity. | 3 | |
| | PHILOS 5540: <i>Theory of Rational Choice</i> | Introduction to the principles and methods of the theory of rational choice with applications in the theory of knowledge, ethics, and social and political philosophy. | 3 | |
| | PHILOS 5550: <i>Advanced Logical Theory</i> | Topics include formal arithmetic, recursive functions, Turing machines, Godel's incompleteness theorems, Church's thesis, arithmetical truth, logical paradoxes, and higher-order logic. | 3 | |

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| ELECTIVE COURSES CONTINUED | PHILOS 5600: <i>Advanced Philosophy of Language</i> | Basic problems and results in the philosophy of language, concentrating on theories of reference, theories of meaning, and theories of language-use (including speech-acts, implicature). | 3 |
| | PHILOS 5800: <i>Advanced Philosophy of Mind</i> | Classical and contemporary approaches to the nature of mind, mind-body, other minds, intentionality, and other problems. | 3 |
| | PHILOS 5840: <i>Advanced Philosophy of Cognitive Science</i> | In-depth examination of the influence of results in cognitive science upon the way in which philosophers approach fundamental issues about the nature of the mind. | 3 |
| | PHILOS 8500: <i>Seminar in Logic</i> | Seminar in Logic. | 1-4 |
| | PHILOS 8600: <i>Seminar in Philosophy of Language</i> | Seminar in Philosophy of Language. | 1-4 |
| | PHILOS 8650: <i>Seminar in Philosophy of Science</i> | Seminar in Philosophy of Science. | 1-4 |
| CHOOSE 2 COURSES | PSYCH 5600: <i>Psychobiology of Learning & Memory</i> | Integrate coverage of animal learning and human memory, focusing on three key components of the field: behavioral processes, brain systems, and clinical perspectives. | 3 |
| | PSYCH 5606: <i>High-Level Vision</i> | Examines the perceptual processes by which humans and other animals are able to obtain knowledge about the three-dimensional environment. | 3 |
| | PSYCH 5608: <i>Introduction to Mathematical Psychology</i> | Survey of mathematical and computational modeling in psychology. Topics include psychophysical scaling, information processing, probabilistic choice, signal detection theory, model comparison, and Bayesian graphical modeling. | 3 |

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| ELECTIVE COURSES CONTINUED <hr style="width: 100%;"/> CHOOSE 2 COURSES | PSYCH 5609: <i>Introduction to Mathematical Models In Experimental Psychology</i> | An introduction to cognition with a focus on the application of mathematical models. Topic areas include memory, decision making, categorization, word recognition, priming, and reaction time. | 3 |
| | PSYCH 5613: <i>Biological Psychiatry</i> | Provides a contemporary overview of the biological bases of several significant psychopathologies, including mood disorders, schizophrenia, and PTSD/dissociative identity disorders. | 3 |
| | PSYCH 5615: <i>Psychology of Language</i> | An introduction to high-level language processing, including word recognition, sentence understanding, and discourse processing. | 3 |
| | PSYCH 5616: <i>Models of Language</i> | Critically examines psychological models of language. Phenomena examined include word recognition, lexical semantics, sentence processing, discourse processing, and general verbal cognition. | 3 |
| | PSYCH 5617: <i>Models of Memory</i> | Examines models of memory and their construction and critically evaluate their claims. Coverage includes abstract and neural models of episodic memory attempting to capture a wide range of behaviors in recognition and recall. | 3 |
| | PSYCH 5618: <i>Introduction to Computational Cognitive Neuroscience</i> | Introductory survey of neural-network models, emphasizing their neural foundations and applications to perceptions, memory, and language. Hands-on explorations with simulation software. | 3 |

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| <p><i>ELECTIVE COURSES CONTINUED</i></p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>PSYCH 5621: <i>Introduction to Event-Related-Potentials</i></p> | <p>Training to become an independent event-related-potential researcher. Develop skills in experimental programming, application of electrode nets, artifact detection, filtering and component analysis, and localization.</p> | 3 |
| | <p>PSYCH 5898: <i>Seminar in Behavioral Neuroscience</i></p> | <p>Team-taught seminar on selected topics from contemporary research areas in the field of behavioral neuroscience.</p> | 3 |
| | <p>PSYCH 6619: <i>Natural Scene Perception</i></p> | <p>Concerns how humans perceive their natural environment. Explores philosophical, psychological, and computational aspects of the perception of natural scenes in readings and discussions.</p> | 3 |
| | <p>PSYCH 6806: <i>Behavioral Neuroscience I</i></p> | <p>The first in a two semester sequence surveying behavioral neuroscience with an emphasis on neurophysiology, the integration of neuronal signaling, and the emergence of high functions.</p> | 3 |
| | <p>PSYCH 6807: <i>Behavioral Neuroscience II</i></p> | <p>The second in a two semester sequence surveying behavioral neuroscience with an emphasis on the age-related changes in the brain, consequences of brain damage and the dementias.</p> | 3 |
| | <p>PSYCH 6861: <i>Design & Methods in Clinical Psychology</i></p> | <p>Introduction to the theory and use of clinical methods in psychology, designed for first-year graduate students in clinical psychology.</p> | 3 |
| | <p>PSYCH 7708: <i>Psychology of Judgment & Decision Making</i></p> | <p>Introductory graduate course in the psychology of judgment and decision making, including applications to health, law, economics, environmental issues, and social, cognitive, and clinical psychology.</p> | 3 |

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| <p><i>ELECTIVE COURSES CONTINUED</i></p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>PSYCH 7820: <i>Fundamentals of Factor Analysis</i></p> | <p>Basic Common Factor Model and its application in psychology; model, communality estimation, factor extraction, orthogonal and oblique rotation, factor scores, confirmatory factor analysis, use of computer programs.</p> | 3 |
| | <p>PSYCH 7821: <i>Covariance Structure Models</i></p> | <p>Theory and methods of testing models of covariance structures; general mathematical model, identification, parameter estimation, goodness of fit, model modification, and the use of computer programs such as LISREL.</p> | 3 |
| | <p>PSYCH 7822: <i>Fundamentals of Item Response Theory</i></p> | <p>Basic concepts underlying item response theory; overview of more advanced topics.</p> | 3 |
| | <p>PSYCH 7823: <i>Analysis of Repeated Measures and Longitudinal Data</i></p> | <p>Review statistical methods for the analysis of repeated measures experiments and longitudinal studies, and investigate the way that participants change over time.</p> | 3 |
| | <p>PSYCH 7824: <i>Non-Parametric Statistics</i></p> | <p>Considers nonparametric and distribution free statistical methods, with emphasis on applications to psychological data.</p> | 3 |
| | <p>PSYCH 7845: <i>Cognitive Development</i></p> | <p>Intensive survey of theory and research in cognitive development, including development of perception, language, memory, concepts, reasoning, academic skills, and social cognition.</p> | 3 |
| | <p>PSYCH 7847: <i>Language Development</i></p> | <p>Survey of language acquisition, including phonemes, words, morphology, syntax.</p> | 3 |
| | <p>PSYCH 7895: <i>Current Issues in Cognitive Development</i></p> | <p>Current topics in cognitive development.</p> | 3 |

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| <p><i>ELECTIVE COURSES CONTINUED</i></p> <hr/> <p>CHOOSE 2 COURSES</p> | <p>SPHHRNG 6150: <i>The Role of the SLP in Autism Spectrum Disorders and Alternative/ Augmentative Communication</i></p> | <p>Provides students with knowledge in autism spectrum disorders and augmentative and alternative communication by integrating research with clinical practice in assessment, treatment, and intervention.</p> | 3 |
| | <p>SPHHRNG 6761: <i>Adult Neurogenic Language Disorders I: Language and Cognition</i></p> | <p>Impairments in communication due to neurologically related changes in language and/or cognition. Pertinent topics include aphasia, traumatic brain injury, dementia and impairments right hemisphere damage.</p> | 4 |
| | <p>SPHHRNG 6725: <i>Language Acquisition and Early Intervention in Language Delay</i></p> | <p>Development of language in children with an emphasis on the interaction between the development of language and cognition with implications for delay. The emphasis is on children aged zero to five years.</p> | 4 |
| | <p>SPHHRNG 6775: <i>Anatomy and Physiology of the Auditory System</i></p> | <p>The structure, function, and stimulus processing capacities of the ear and central auditory pathways as they relate to performance on tests of auditory function in normal and impaired listeners.</p> | 4 |
| | <p>SPHHRNG 7820: <i>Acoustic Phonetics</i></p> | <p>An introduction to the acoustic characteristics of human speech sounds, the acoustic theory of speech production, and spectrographic analysis.</p> | 3 |
| | <p>SPHHRNG 8950: <i>Seminar in Speech and Hearing Science</i></p> | <p>Advanced seminars in speech and hearing science and disorders.</p> | 2 |