**850. Electrodynamics of Plasmas**
*Spring of odd years. 3(3-0) Interdepartmental with Astronomy and Astrophysics; and Physics. P: ECE 835 or PHY 488.*
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.
*SA: EE 850*

**863. Analysis of Stochastic Systems**
*Fall. 3(3-0) P: STT 441.*
Advanced topics in random variable theory. Stochastic processes and stochastic calculus. Optimal systems for filtering and detection.
*SA: EE 863*

**864. Detection and Estimation Theory**
*Spring. 3(3-0) P: ECE 863*
Analysis and implementation of statistical estimation and detection methods used in signal processing, communications, and control applications. Bayesian, Neyman-Pearson, and minimax detection schemes. Bayesian, mean-square-error, and maximum-likelihood estimation methods.
*SA: EE 864*

**865. Analog and Digital Communications**
*Fall of odd years. 3(3-0) P: ECE 457, ECE 863*
Optimum signal design in noisy channels, matched filters, quadrature sampling of bandpass signals in noise. Coherent and non-coherent binary modulation such as PSK, FSK, DPSK, M-ary modulation, intersymbol interference, spread spectrum.
*SA: EE 865*

**874. Physical Electronics**
*Fall. 3(3-0)*
Applications of quantum mechanics and statistical mechanics in solids. Band theory of semiconductors. Electrical transport phenomena. Pn junctions.
*SA: EE 874*

**875. Electronic Devices**
*Spring. 3(3-0) P: ECE 874.*
Operating properties of semiconductor devices including DC, AC, transient and noise models of FET, BJT, metal-semiconductor contact, heterostructure, microwave and photonic devices.
*SA: EE 875*

**885. Artificial Neural Networks**
*Fall. 3(3-0) Interdepartmental with Computer Science and Engineering.*
Overview of neuro-engineering technology. Basic neural network architectures. Feedforward and feedback networks. Temporal modeling. Supervised and unsupervised learning. Implementation. Basic applications to pattern recognition.
*SA: EE 885*

**899. Master's Thesis Research**
*Fall, Spring, Summer. 1 to 8 credits. A student may earn a maximum of 24 credits in all enrollments for this course.*
*SA: EE 899*

**920. Selected Topics in High Performance Computer Systems**
*Spring of odd years. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. Interdepartmental with Computer Science and Engineering. Administered by Computer Science and Engineering. P: CSE 822. R: Open only to Computer Science or Electrical Engineering majors.*
Design of high performance computer systems. Seminar format.
*SA: EE 920*

**921. Advanced Topics in Digital Circuits and Systems (MTC)**
*Fall, Spring. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Computer Science and Engineering.*
Topics vary each semester. Topics such as testable and fault-tolerant digital systems, embedded architectures.
*SA: EE 921*

**925. Advanced Topics in Power (MTC)**
*Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.*
Topics vary each semester. Topics such as advanced stability and control of power systems, power system planning, or advanced machine drives.
*SA: EE 925*

**929. Advanced Topics in Electromagnetics (MTC)**
*Fall, Spring. 3 to 4 credits. A student may earn a maximum of 10 credits in all enrollments for this course.*
Topics vary each semester. Topics such as planar waveguides and circuits, antenna theory, geometrical theory of diffraction.
*SA: EE 929*

**931. Advanced Topics in Electronic Devices and Materials (MTC)**
*Fall, Spring. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.*
Topics vary each semester. Topics such as VLSI technology, microdevices and microstructures, properties of semiconductors.
*SA: EE 931*

**960. Advanced Topics in Control (MTC)**
*Fall. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.*
Topics vary each semester. Topics such as adaptive control, or nonlinear control.
*SA: EE 960*

**963. Advanced Topics in Systems (MTC)**
*Fall, Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.*
Topics vary each semester. Topics such as system identification and adaptive filtering, robot dynamics and control, or learning in artificial neural networks.
*SA: EE 963*

**966. Advanced Topics in Signal Processing (MTC)**
*Fall, Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course.*
Topics vary each semester. Topics such as discrete time processing of speech signals, multidimensional signal processing, or detection and estimation theory.
*SA: EE 966*

**989. Advanced Topics in Plasma (MTC)**
*Fall of odd years. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.*
Topics vary each semester. Topics such as plasma processing for IC fabrication, plasma diagnostic techniques.
*SA: EE 989*

**999. Doctoral Dissertation Research**
*Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 72 credits in all enrollments for this course.*
*SA: EE 999*

## ENGINEERING EGR

### College of Engineering

**101. Preview of Science**
*Fall. 1(1-0) Interdepartmental with Natural Science; Agriculture and Natural Resources; and Social Science. Administered by Natural Science. R: Approval of College*
Overview of natural sciences. Transitional problems. Communications and computer skills. Problem solving skills. Diversity and ethics problems in science. Science and society.

**124. Internet and Technology**
*Fall, Spring, Summer. 2(2-0)*
The Internet from a user perspective and from a technical perspective. History and social impact of the Internet. Internet tools.

**150. Engineers and the Engineering Profession**
*Spring. 2(2-0) R: Open only to freshmen or sophomores.*
Overview of the engineering profession. Historical background. Engineering specialities. Engineers at work. Professionalism and ethics. Communication skills. Future trends and challenges.

**160. Diversity and Engineering**
*Fall, Spring. 2(2-0) P: (MTH 132 or concurrently) R: Open only to freshmen or sophomores in the College of Engineering.*
Issues relevant to underrepresented engineering groups. Diversity and engineering. Transitional problems. Career options. Communication skills.

**192. Environmental Issues Seminar**
*Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Natural Science; Agriculture and Natural Resources; Social Science; and Communication Arts and Sciences. Administered by Natural Science. R: Open only to students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science or College of Communication Arts and Sciences or College of Social Science. Approval of college.*
Environmental issues and problems explored from a variety of perspectives, including legal, scientific, historical, political, socio-economic, and technical points of view.

**200. Technology, Society and Public Policy**
*Fall. 2(2-0) P: 2 courses in mathematics or engineering or science. R: Open only to sophomores or juniors or seniors.*
Description and analysis of certain technologies and their consequences. Development of techniques for assessing consequences as an aid to formulation of public policy.

**290. Independent Study**
*Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Open only to students in the College of Engineering, approval of college.*
Independent undergraduate research in engineering.

**291. Selected Topics**
*Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Open only to freshmen or sophomores.*
Experimental course development or special topics appropriate for freshmen and sophomores.

**393. Engineering Cooperative Education**
*Fall, Spring, Summer. 1(1-0) A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to students in the College of Engineering.*
Pre-professional educational employment experiences in industry and government related to student's major. Educational employment assignment approved by College of Engineering.

**400. Special Problems in International Engineering**
*Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors or graduate students in the College of Engineering.*
Supervised study of selected topics in engineering using laboratories, equipment, and engineering design techniques. Given at various international universities and institutes.

**475. Special Topics in International Engineering**
*Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to juniors or seniors or graduate students in the College of Engineering.*
Topics selected to supplement regular courses. Given at various international universities and institutes.

**888. Capstone Project in Manufacturing**
*Spring. 3(1-6) Interdepartmental with Marketing and Supply Chain Management. R: Open only to juniors or seniors in the Manufacturing Engineering major or to students in the Business Management of Manufacturing major.*
Problem solving in manufacturing. Design of products and processes for manufacturing using a systems approach. Teaming and communication skills are emphasized.

# ENGLISH ENG

### Department of English
### College of Arts and Letters

**090A. Intensive English for Non-Native Speakers**
*Fall, Spring. 0 credit. [12(20-0) See page A-2, item 3.] R: Approval of English Language Center.*
Explanation and intensive practice of English skills. Focus on beginning grammar, speaking, listening, reading, and writing.

**090B. Intensive English for Non-Native Speakers**
*Fall, Spring. 0 credit. [12(20-0) See page A-2, item 3.] R: Approval of English Language Center.*
Explanation and intensive practice of English skills. Focus on intermediate grammar, speaking, listening, reading, and writing.

**090C. Intensive English for Non-Native Speakers**
*Fall, Spring. 0 credit. [12(20-0) See page A-2, item 3.] R: Approval of English Language Center.*
Explanation and intensive practice of English skills. Focus on advanced grammar, speaking, listening, reading, and writing.

**091. English Structure for Non-Native Speakers**
*Fall, Spring. 0 credit. [3(3-0) See page A-2, item 3.] R: Approval of English Language Center.*
Explanation and practice of advanced grammatical structures of English in relation to written communication. Emphasis on editing skills.

**092. Academic Oral Skills for Non-Native Speakers of English**
*Fall, Spring. 0 credit. [3(3-0) See page A-2, item 3.] R: Approval of English Language Center.*
Intensive speaking and listening practice of spoken academic English. Lecture-listening and note-taking strategies. Oral communication skills improved through discussions and classroom presentations.

**093. Academic Reading and Writing Skills for Non-Native Speakers of English**
*Fall, Spring. 0 credit. [6(6-0) See page A-2, item 3.] R: Approval of English Language Center.*
Integrative reading and writing strategies for academic purposes. Vocabulary development, intensive and extensive reading, and critical reading skills. Academic writing style and editing strategies.

**094. Academic Reading Skills for Non-Native Speakers of English**
*Fall, Spring. 0 credit. [3(3-0) See page A-2, item 3.] R: Approval of English Language Center.*
Intensive and extensive reading skills. Vocabulary development, pre-reading strategies, reading for comprehension, and critical reading skills.

**095. Academic Writing Skills for Non-Native Speakers of English**
*Fall, Spring. 0 credit. 3(3-0) See page A-2, item 3.] R: Approval of English Language Center.*
Writing, editing, and revision of journals, essays and research papers.

**096. Pronunciation and Listening for Non-native Speakers of English**
*Fall, Spring, Summer. 0 credit. [3(3-0) See page A-2, item 3.] R: Approval of English Language Center.*
Practice in pronunciation: discrete sounds, rhythm, and stress. Listening comprehension. Listening for main ideas and details.

**097. Oral Skills for Foreign Teaching Assistants**
*Fall, Spring. 0 credit. [3(5-0) See page A-2, item 3.] R: Approval of English Language Center.*
Practice in English skills for classroom instruction. Pronunciation. Presentations and handling questions. Managing student interactions and classroom situations.

**101. Cross-Cultural Literature**
*Fall, Spring, Summer. 4(4-0)*
Fiction, drama, or poetry of major authors, written in or translated into English, reflecting a broad range of cultures.

**102. Everyday English**
*Fall, Spring, Summer. 4(4-0)*
Contemporary uses of English. Dialects and genderlects; doublespeak; political correctness; historical origins; the "U.S. English" movement.

**106. Contemporary Life Through Literature**
*Fall, Spring, Summer. 4(4-0)*
Contemporary literature written since 1945 exploring issues in modern life. Personal or public, artistic or political, natural or cultural.

**108. Children's Literature and Literature for Young Adults**
*Fall, Spring, Summer. 4(4-0)*
Children's literature and different genres of literature for young adults, including realistic and historical fiction, modern fantasy, myth, legend, poetry, and nonfiction.

**110. The Comic Impulse in Narrative, Drama, and Film.**
*Fall, Spring, Summer. 4(4-0)*
Comedy from classical literature to the present, drawing on novels, drama, films and humorous verse. Humor and its relation to culture.

**120. Great Books of Western Literature**
*Fall, Spring, Summer. 4(4-0)*
Literary texts of varied eras and genres that have exerted enduring influence on English and related literatures.