ELECTRICAL ENGINEERING (ELEG)

ELEG 1011 Introduction to Electrical Engineering
Prerequisite: Math ACTE score of 24 or higher, or a grade of C or higher in MATH 1113, or MATH 1914, or MATH 1203, or consent of the instructor.
An introductory lecture/lab course to acquaint students with the fundamental techniques in the field of electrical engineering. Topics include technical aspects of electrical engineering including an introduction to computational techniques/software, basic introduction to computer-aided drafting (CAD), an introduction to programming, and basic circuit prototyping. $25 per credit hour curriculum content fee.

ELEG 2103 Electric Circuits I
Prerequisite: MATH 2924 with a grade of C or better.
An introduction to circuit theory and electrical devices. Topics include resistive circuits, independent and dependent sources; analysis methods, network theorems; RC and RL first order circuits, and RLC second order circuits. $25 per credit hour curriculum content fee.

ELEG 2111 Electric Circuits Laboratory
Prerequisite: ELEG 2103.
Report writing; use of basic electrical measurement devices; voltmeters, ammeters, R meters, wattmeters, and oscilloscopes. Computer modeling and data analysis of AC and DC circuits. Emphasis on developing laboratory techniques through experiments paralleling topics in ELEG 2103 and ELEG 2113. Laboratory three hours per week. $40 laboratory fee. $25 per credit hour curriculum content fee.

ELEG 2113 Electric Circuits II
Prerequisite: ELEG 2103 with a C or better and MATH 3243 or consent of instructor.
A continuation of ELEG 2103 covering phasor analysis, steady state power, complex network functions, frequency response, transformers, Laplace methods. $25 per credit hour curriculum content fee.

ELEG 2130 Digital Logic Design Lab
Co-requisite: ELEG 2134 or consent of instructor.
Laboratory must be taken during the same semester as the lecture, ELEG 2134. A study of basic digital logic circuit design and implementation. Circuit schematic development utilizing computerized automated design tools. Computer modeling and simulation of digital systems. Emphasis will be placed on proper laboratory techniques, including data collection, data reduction, and report preparation. Laboratory three hours. $40 laboratory fee.

ELEG 2134 Digital Logic Design
Prerequisite: ELEG 1011 or COMS 1013 Co-requisites: ELEG 2130 Binary numbers and codes, Boolean algebra, combinational and sequential logic including: minimization techniques, memory systems, register transfers, control logic design, and state machines.
$25 per credit hour curriculum content fee.

ELEG 3000 Engineering Internship/Research Experience
Cross-listed: MCEG 3000.
Offered: As needed.
Prerequisite: A minimum of 60 hours applicable toward the ATU Electrical/Mechanical engineering program requirements with a minimum 3.5 GPA; and acceptance in an Engineering Internship or Research Experience for Undergraduates Program.
A minimum of six weeks of supervised on-the-job training with a university research program, engineering firm, manufacturer, municipality, or company employing engineers. A written report is required within one week of internship completion. Students will also present their internship experience to an engineering class or at a student engineering RSO meeting.
Note: Satisfies College of Distinction requirement.

ELEG 3003 System Modeling and Analysis
Cross-listed: MCEG 3003 Prerequisites: COMS 1013 or MCEG 2203 and MATH 3243 Reduction of engineering systems to mathematical models; methods of analysis using computers; interpretation of numerical results; optimization of design variables.
Examples are drawn from various engineering disciplines. $25 per credit hour curriculum content fee.

ELEG 3103 Electronics I
Prerequisite: ELEG 2111 and ELEG 2113 Physics and electrical characteristics of diodes, bipolar transistors, and field effect transistors, behavior of these devices as circuit elements; common electronic circuits in discrete and integrated form; digital circuits including standard IC gates and flip flops, linear circuits including standard discrete and integrated amplifier configurations and their characteristics.
$25 per credit hour curriculum content fee.

ELEG 3123 Signals and Systems
Prerequisite: MATH 3243 and ELEG 2113.
Signal and system modeling, time and frequency domain analysis, singularity functions, the Dirac Delta function, impulse response, the superposition integral and convolution, Fourier series and Fourier and Laplace transformations. $25 per credit hour curriculum content fee.

ELEG 3133 Microprocessor Systems Design
Prerequisite: ELEG 2134 and ELEG 2130.
Digital design using microprocessors. Microcomputer architecture, memory structures, I/O interfaces, addressing modes, interrupts, assembler programming, and development tools. This course should also attract computer science students interested in hardware. $25 per credit hour curriculum content fee.

ELEG 3143 Electromagnetics
Prerequisite: MATH 2934 and PHYS 2124.
An introduction to static and dynamic electromagnetic fields using vector methods. Transmission lines, electrostatic fields, magnetostatic fields, Maxwell's equations, plane electromagnetic wave propagation, reflection, refraction, attenuation, antennas, reciprocity, and gain. $25 per credit hour curriculum content fee.

ELEG 3153 Electrical Machines
Prerequisite: ELEG 2113.
Steady state analysis of single phase and polyphase transformers, direct current machines, synchronous machines, induction machines, and special purpose machines. Special emphasis will be given to the modeling and control of these machines. $25 per credit hour curriculum content fee.

ELEG 3163 Electric Power Systems
Prerequisite: ELEG 2113 and PHYS 2124.
Introduction to power system analysis and operation. Topics included: mathematical modeling of power system components, power flow analysis, symmetric and asymmetric faults and economic operation of power systems. $25 per credit hour curriculum content fee.

ELEG 3203 Renewable Energy Technology
Prerequisite: ELEG 2113.
An introduction and comprehensive overview of renewable energy technology. Topics include distributed generations and renewable energies including wind power, solar power, fuel cells and hydropower. Emphasis will be placed on basic concepts, operation principles and economics of existing and emerging renewable energy technologies. $25 per credit hour curriculum content fee.

ELEG 4103 Electronics II
Prerequisite: ELEG 3103.
A continuation of ELEG 3103 specializing in characteristics and applications of both linear and digital integrated circuits; amplifiers, feedback analysis, frequency response, oscillators, amplifier stabilization, microprocessors, memory systems, emphasis on design. $25 per credit hour curriculum content fee.

ELEG 4113 Digital Signal Processing
Prerequisite: ELEG 3123 and ELEG(MCEG) 3003.
The study of discrete-time signals and systems, convolution, correlation, z-transform, discrete-time Fourier transform, analysis and design of digital filters. $25 per credit hour curriculum content fee.

ELEG 4122 Electrical Systems Lab
Offered: Spring.
Prerequisite: ELEG 3103.
The course presents advanced topics in electrical engineering system design. Topics include discrete components, ICs, PLCs, and data acquisition systems. $40 laboratory fee. $25 per credit hour curriculum content fee.

ELEG 4133 Advanced Digital Design
Prerequisite: ELEG 2134.
Principles of digital systems design and the use of hardware description languages (HDL) are targeted toward the development of programmable logic devices in this project oriented course. The basic tenets of HDL will be presented including design flow, structural and behavioral descriptions, data types, concurrent and sequential statements, processes, procedures, functions, and packages. Approximately one hour per week will be devoted to supervised project development. $25 per credit hour curriculum content fee.

ELEG 4143 Communication Systems I
Prerequisite: ELEG 3123.
An introduction to design and analysis of analog and digital communication systems. Amplitude and angle modulation and demodulation, bandwidth, frequency division multiplexing, sampling and pulse- code modulation, detection error statistics in digital communication. $25 per credit hour curriculum content fee.

ELEG 4153 Communication Systems II
Prerequisite: ELEG 4143.
Continuation of ELEG 4143. Design and analysis of analog and digital communication systems, taking into account the effects of noise. Random variables, random processes, analog and digital communication systems in the presence of noise. $25 per credit hour curriculum content fee.

ELEG 4191 Electrical Design Project I
Prerequisite: ELEG/MCEG 4202.
First of a two part sequence of courses to complete a group project in electrical engineering design. Emphasis will be placed on designing an electrical system or subsystem with due regard for Safety, environmental concerns, reliability, longevity, ease of manufacture, maintainability, and cost effectiveness. A written and oral report are required. $25 per credit hour curriculum content fee.

ELEG 4192 Electrical Design Project II
Prerequisite: ELEG 4191.
Second of a two part sequence of courses to complete a group project in electrical engineering design. Emphasis will be placed on designing an electrical system or subsystem with due regard for Safety, environmental concerns, reliability, longevity, ease of manufacture, maintainability, and cost effectiveness. A written and oral report are required. $50 course fee. $25 per credit hour curriculum content fee.

ELEG 4202 Engineering Design
Cross-listed: MCEG 4202.
Prerequisite: ELEG 3103.
This course serves as the first part of a two course sequence in which the student completes a senior design project. Design methodologies and tools including real world design considerations such as environmental impact, engineering ethics, economics, safety, product costing and liability are introduced. Design for manufacture, project management, scheduling and proposal writing will be covered. Successful completion of this course shall require completion of a proposal for a senior design project being accepted by the faculty design project review process. $25 per credit hour curriculum content fee.

ELEG 4303 Control Systems
Prerequisite: ELEG (MCEG) 3003 and ELEG 2113.
An introduction to the field of control system engineering. Topics include: open and closed loop systems; mathematical modeling of electrical and mechanical systems; linearization; stability; block diagram reduction; signal flow graphs; transient analysis; stability analysis; root locus analysis; frequency analysis; and an introduction to compensator design. $25 per credit hour curriculum content fee.

ELEG 4313 Modern Control Systems
Prerequisite: ELEG 4303.
A continuation of ELEG 4303 Control Systems. Topics include: frequency response design, state space analysis, controllability, observability, state space design, robustness, and an introduction to digital control. $25 per credit hour curriculum content fee.

ELEG 4951 Undergraduate Research in Electrical Engineering
Offered: On demand.
Prerequisite: Departmental approval.
Advanced students carry out independent research activity relating to a significant problem in a major field of study. Supervised by faculty member. Formal report and presentation required. One to four credits depending on problem selected and effort made. $25 per credit hour curriculum content fee.

ELEG 4952 Undergraduate Research in Electrical Engineering
Offered: On demand.
Prerequisite: Departmental approval.
Advanced students carry out independent research activity relating to a significant problem in a major field of study. Supervised by faculty member. Formal report and presentation required. One to four credits depending on problem selected and effort made. $25 per credit hour curriculum content fee.

ELEG 4953 Undergraduate Research in Electrical Engineering
Offered: On demand.
Prerequisite: Departmental approval.
Advanced students carry out independent research activity relating to a significant problem in a major field of study. Supervised by faculty member. Formal report and presentation required. One to four credits depending on problem selected and effort made. $25 per credit hour curriculum content fee.

ELEG 4954 Undergraduate Research in Electrical Engineering
Offered: On demand.
Prerequisite: Departmental approval.
Advanced students carry out independent research activity relating to a significant problem in a major field of study. Supervised by faculty member. Formal report and presentation required. One to four credits depending on problem selected and effort made. $25 per credit hour curriculum content fee.

ELEG 4991 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

ELEG 4992 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

ELEG 4993 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

ELEG 4994 Special Problems in Engineering
Prerequisite: Minimum of three hours at the junior level in area of study.
Individual study in advanced area of the student's choice under the direction of a faculty advisor. $25 per credit hour curriculum content fee.

ELEG 5113 Digital Signal Processing
Prerequisite: ELEG 3123 and 3133.
The study of discrete-time signals and systems, convolution, z-transform, discrete-time Fourier transform, analysis and design of digital filters. Students write software for real-time implementation of selected signal processing algorithms using DSP microcomputer hardware.
Note: May not be taken for credit after completion of ELEG 4113.

ELEG 5133 Advanced Digital Design
Prerequisite: ELEG 2130 and 2134.
A project oriented course in which students develop and test custom digital integrated circuits (IC's). An overview of IC design systems and manufacturing processes is presented. Economics of IC production are discussed. Hardware Description Languages (HDL's) are studied. Students design and implement custom IC's using schematic based entry and HDL's.
Note: May not be taken for credit after completion of ELEG 4133.

ELEG 5153 Communication Systems II
Prerequisite: ELEG 4143.
Continuation of ELEG 4143. Design and analysis of analog and digital communication systems, taking into account the effects of noise. Random variables, random processes, analog and digital communication systems in the presence of noise.
Note: May not be taken for credit after completion of ELEG 4153.

ELEG 5313 Modern Control Systems
Prerequisite: ELEG 4303.
A continuation of ELEG 4303 Control Systems. Topic include: frequency response design, state space analysis, controllability, observability, state space design, robustness and introduction to digital control.
Note: May not be taken for graduate credit after completion of ELEG 4313.

ELEG 5993 Special Problems in Engineering I
Prerequisite: Permission of instructor.
An individual or group study in an advanced area of engineering under the direction of a faculty member. May be taught in conjunction with an associated ELEG 4993 section with the same topic. This course may be repeated for credit if course content varies.
Note: May not be taken for credit after gaining credit for a 4993 section with the same topic.

ELEG 6103 Power Electronics
Prerequisite: ELEG 4103 or permission of instructor.
The course will cover the following topics: Characteristics of thyristors, sequential switching, triggering and synchronizing circuitry. Conversion and control of electric power, design of electric power controller; rectifiers, converters, inverters, and cycloconverters, controlling techniques for DC and AC machines will be presented.

ELEG 6123 Advanced Semiconductors
Prerequisite: ELEG 3003 and ELEG 4103 or permission of the instructor
An in depth overview of coverage of semiconductor devices and materials.
The course presents and examines semiconductor fundamentals required in the operational analysis of microelectronic devices.

ELEG 6133 Introduction to Nanoelectronics
This course is designed to give the graduate student an introduction to the engineering problems and concepts that are involved in electrical and electromechanical devices at the nanoscale. The course will cover the wave properties of matter, quantum mechanics, optical properties of materials, nanolithography, and various nanostructure devices such as field-effect transistors, light-emitting diodes and lasers and nanoelectromechanical devices.

ELEG 6143 Digital Image Processing
Prerequisite: ELEG 3133, ELEG 4113, and ELEG/MCEG 3003 or permission of the instructor.
The course will cover the following topics: components of digital image processing systems, histograms, point processing, neighborhood processing, image restoration, image segmentation, 2-D discrete Fourier transform, image data compression, color image processing.

ELEG 6153 Statistical Signal Processing
Prerequisite: ELEG 4113 and ELEG/MCEG 3003 or permission of the instructor.
The course will cover the following topics: minimum variance unbiased estimators, Cramer-Rao lower bound, maximum likelihood estimators, Least Squares, Kalman filter.

ELEG 6163 Biomedical Signal Processing
Prerequisite: ELEG 4113 or permission of the instructor.
The study, analysis, and implementation of advanced method in signal processing applied to biomedical signals and systems. Engineers working in the biomedical field routinely design and build signal processing algorithms and devices to analysis biomedical signals for diagnostic analysis and prosthetic control. In order to appropriately design systems for biomedical signal processing it is necessary to have a basic understanding of the origin and characteristic of these signals. The course will focus on single dimensional deterministic and random signal processing.

ELEG 6303 Robotics
Prerequisite: ELEG 3133, ELEG 4303, ELEG/MCEG 3003 or permission of the instructor.
The course will cover the following topics: robotics paradigms, path planning, motion planning, configuration space, potential functions, localization and mapping, sensors and actuators.

ELEG 6881 Special Topics in Engineering
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

ELEG 6882 Special Topics in Engineering
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

ELEG 6883 Special Topics in Engineering
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

ELEG 6884 Special Topics in Engineering
Special topics in engineering relating to current engineering topics not covered in other courses.
Note: May be repeated for credit if course content varies.

ELEG 6891 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6892 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6893 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6894 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6895 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6896 Independent Study
Prerequisite: Completion of 18 hours toward program requirements and approval of advisor.
Students will complete an electrical engineering project approved by their Advisory Committee. The project must include elements of engineering design and project management with a subject relevant to electrical engineering. Successful completion of the project will include a professional report and full presentation of the project findings/results.
Note: May be repeated for credit if course content varies.

ELEG 6991 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

ELEG 6992 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

ELEG 6993 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

ELEG 6994 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

ELEG 6995 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to
submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.

ELEG 6996 Research Project
Prerequisite: Research topic approved by student's advisory committee.
Research of an engineering related topic. Students will be required to
submit a final written report and a symposium presentation.
Note: Course may be repeated for a total of 6 credit hours.