Electrical Engineering (ELEG)

Courses

**ELEG 1011 Intro Engr Computer Sci & Tech: 1 semester hour.**
Introduction to basic engineering, computer science and technology concepts. Students will become aware of the various disciplines of engineering, computer science and technology, ethical and professional responsibilities in these fields, creativity and design.

**ELEG 1021 Introduction to Electrical and Computer Engineering Laboratory: 1 semester hour.**
An introduction to the practice of electrical and computer engineering including identifying electronic components, operating electronic test and measurement instruments. Laboratory exercises include signal generators, passive components, and electronic circuits involving diodes, operational amplifiers and sensors.

**ELEG 1043 Computer Applications in Engineering: 3 semester hours.**
Fundamentals of C++ Programming language and MATLAB applications software. Logic of algorithms, flowcharts, program looping, conditional statements, arrays, functions and pointers, Engineering applications and team projects.
Prerequisites: MATH 1113 (http://catalog.pvamu.edu/search/?P=MATH%201113) (may be taken concurrently) or MATH 1115 (http://catalog.pvamu.edu/search/?P=MATH%201115) (may be taken concurrently) or MATH 1123 (http://catalog.pvamu.edu/search/?P=MATH%201123) (may be taken concurrently) or MATH 1124 (http://catalog.pvamu.edu/search/?P=MATH%201124) (may be taken concurrently) or MATH 2024 (http://catalog.pvamu.edu/search/?P=MATH%202024) (may be taken concurrently).

**ELEG 2011 Electric Circuits Laboratory: 1 semester hour.**
Prerequisites: ELEG 2023 (http://catalog.pvamu.edu/search/?P=ELEG%202023) (may be taken concurrently).

**ELEG 2023 Network Theory I: 3 semester hours.**
Study of basic circuit laws and theorems. Study of basic circuit analysis techniques, use of controlled sources, and transient and sinusoidal circuit analysis.
Prerequisites: PHYS 2523 (http://catalog.pvamu.edu/search/?P=PHYS%202523) and MATH 2043 (http://catalog.pvamu.edu/search/?P=MATH%202043) (may be taken concurrently).

**ELEG 2053 Introduction to Electrical Engineering: 3 semester hours.**
Introductory course for non-majors. Basic circuit theory, analysis of DC circuits; transient analysis of RLC circuits; steady state analysis; transformers; DC machines and induction motors; diode circuits; operational amplifiers; numbering systems, logic gates and combinational circuits.
Prerequisites: MATH 2043 (http://catalog.pvamu.edu/search/?P=MATH%202043) (may be taken concurrently) and PHYS 2523 (http://catalog.pvamu.edu/search/?P=PHYS%202523).

**ELEG 3013 Network Theory II: 3 semester hours.**
Continuation of transient and sinusoidal analysis. Study of average and RMS power, poly-phase circuits, complex frequency, frequency response, and magnetic circuits.
Prerequisites: ELEG 2023 (http://catalog.pvamu.edu/search/?P=ELEG%202023).

**ELEG 3021 Logic Circuits Laboratory: 1 semester hour.**
Experimentation in combinational and sequential logic circuitry. Design of counters, adders, digital display circuitry, shift registers, and control logic.
Prerequisites: ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063) (may be taken concurrently).

**ELEG 3023 Signals and Systems: 3 semester hours.**
Basic discrete and continuous time signals, properties of systems, linear time invariant systems, Fourier analysis, z-transformers, LaPlace Transform.
Prerequisites: ELEG 3013 (http://catalog.pvamu.edu/search/?P=ELEG%203013).

**ELEG 3033 Physical Principles of Solid State Devices: 3 semester hours.**
Crystal structure, introduction to quantum concepts and discrete energy levels; atomic bonding, soli-state band theory, Fermi-Dirac statistics, charge carrier transport, and introduction to semiconductor device physics and operation.
Prerequisites: CHEM 1034 (http://catalog.pvamu.edu/search/?P=CHEM%201034) or CHEM 1043 (http://catalog.pvamu.edu/search/?P=CHEM%201043) and MATH 2043 (http://catalog.pvamu.edu/search/?P=MATH%202043) and PHYS 2523 (http://catalog.pvamu.edu/search/?P=PHYS%202523).

**ELEG 3041 Microelectronic Processing and Characterization Lab: 1 semester hour.**
Basic processes of microelectronic fabrication; doping, oxidation, photolithography, etching, metallization and clean room practices. Basic materials and device characterization.
Prerequisites: ELEG 3033 (http://catalog.pvamu.edu/search/?P=ELEG%203033) and ELEG 2011 (http://catalog.pvamu.edu/search/?P=ELEG%202011).
ELEG 3043 **Electronics I: 3 semester hours.**
Prerequisites: ELEG 3033 (http://catalog.pvamu.edu/search/?P=ELEG%203033) (may be taken concurrently) and ELEG 3013 (http://catalog.pvamu.edu/search/?P=ELEG%203013).

ELEG 3063 **Logic Circuits: 3 semester hours.**
Number systems and codes. Boolean algebra and logic minimization methods. Combinational and sequential design using logic gates and flip flops. Computer-aided design tools for digital design, simulation, and testing.
Prerequisites: ELEG 2023 (http://catalog.pvamu.edu/search/?P=ELEG%202023).

ELEG 3071 **Microprocessor Systems Design Laboratory: 1 semester hour.**
Software and hardware experiments with a microprocessor system. Assembly language and C programming, simple input/output interfacing, and interrupt processing in microcomputer systems.
Prerequisites: ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063) and ELEG 1043 (http://catalog.pvamu.edu/search/?P=ELEG%201043) or COMP 1213 (http://catalog.pvamu.edu/search/?P=COMP%201213) and ELEG 3073 (http://catalog.pvamu.edu/search/?P=ELEG%203073) (may be taken concurrently).

ELEG 3073 **Microprocessor System Design: 3 semester hours.**
Introduction to architecture, operation, and application of microprocessors; microprocessor programming; address decoding; system timing; parallel, serial, and analog 110; interrupts and direct memory access; interfacing to static and dynamic RAM; microcontrollers. Introduction to Microcomputers.
Prerequisites: ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063) and ELEG 1043 (http://catalog.pvamu.edu/search/?P=ELEG%201043) or COMP 1213 (http://catalog.pvamu.edu/search/?P=COMP%201213). Co-requisite: ELEG 3071 (http://catalog.pvamu.edu/search/?P=ELEG%203071).

ELEG 3156 **Engineering Internship I: 6 semester hours.**
An internship program or work experience with an approved engineering firm or engineering oriented business agency, planning, public service agency, or consulting firm, providing an introduction to the profession.

ELEG 4003 **Communication Theory: 3 semester hours.**

ELEG 4011 **Electronics Laboratory: 1 semester hour.**
Applications of semiconductors diodes. Operational characteristics of transistor amplifiers (inverters, emitter follower, difference, etc.) FET characteristics and applications. Operational amplifier characteristics and circuit implementation. Frequency response of amplifiers.
Prerequisites: ELEG 2011 (http://catalog.pvamu.edu/search/?P=ELEG%202011) and ELEG 3043 (http://catalog.pvamu.edu/search/?P=ELEG%203043) (may be taken concurrently).

ELEG 4013 **Electromechanical Energy Conversion: 3 semester hours.**
Electric and magnetic devices, force and torque measurements, iron core transformers, single phase and poly-phase power circuit analysis. Introduction to per unit system.
Prerequisites: ELEG 3013 (http://catalog.pvamu.edu/search/?P=ELEG%203013) and MATH 4173 (http://catalog.pvamu.edu/search/?P=MATH%204173).

ELEG 4021 **Power Laboratory: 1 semester hour.**
Operational characteristics of DC and AC machines; Transformers; power circuit analysis, DC to DC converters, Inverters; DSP-Based Electric Drive Systems.
Prerequisites: ELEG 4013 (http://catalog.pvamu.edu/search/?P=ELEG%204013) (may be taken concurrently).

ELEG 4023 **Power Systems Engineering: 3 semester hours.**
Elementary synchronous machines. General considerations of power generation, transmission, distribution and utilization, survey of load flow, faults, transient stability and economic power dispatch.
Prerequisites: ELEG 4013 (http://catalog.pvamu.edu/search/?P=ELEG%204013).

ELEG 4031 **Communications Lab: 1 semester hour.**
Laboratory practice of communications theory, AM and FM modulation, transmission and reception. Analysis of signals and effect of noise interference on communications.
Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003) (may be taken concurrently).

ELEG 4033 **Electromagnetic Field Theory I: 3 semester hours.**
Review of relevant mathematics, electricity, and magnetism. Study of dielectrics, Poisson's and LaPlace's equations, magnetic flux, magnetic fields, and magnetic boundary conditions, Ampere's Circuit law, time varying fields and Maxwell's equations.
Prerequisites: ELEG 2023 (http://catalog.pvamu.edu/search/?P=ELEG%202023) and MATH 4173 (http://catalog.pvamu.edu/search/?P=MATH%204173).
ELEG 4043 Electronics II: 3 semester hours.
Design and analysis of single and multistage transistor amplifiers, difference amplifiers, frequency response of amplifiers. Feedback concepts. Analysis and design using discrete and integrated devices.
Prerequisites: ELEG 3043.

ELEG 4053 Digital Signal Processing: 3 semester hours.
Introduction, review of signals and systems, sampling and z-transforms, discrete Fourier transform, fast Fourier transform, non-recursive filter design, recursive filter design. Use of Matlab and DSP’s in signal analysis.
Prerequisites: ELEG 3023.

ELEG 4073 Servomechanism and Control Systems: 3 semester hours.
Model of physical systems, system responses, system characteristics, stability design, frequency response analysis and design, discrete-time systems.
Prerequisites: ELEG 3023 and MATH 4173.

ELEG 4103 Special Topics: 3 semester hours.
Selected current and emerging topics in Electrical Engineering. Courses may be repeated for credit when topics vary.

ELEG 4151 Digital Signal Processing: 1 semester hour.
Prerequisites: ELEG 4053 (may be taken concurrently) or ELEG 4163 (may be taken concurrently).

ELEG 4156 Engineering Internship II: 6 semester hours.
An internship program or work experience with an approved engineering firm or engineering oriented business agency, planning agency, public service agency, or consulting firm which provides an introduction to the profession.

ELEG 4163 Digital Signal Processing: 3 semester hours.
Fundamental techniques of Digital Signal Processing design, algorithm development, system simulation, real-time prototype of DSP systems.
Fundamental techniques of DSP testing, DSP software, hardware and different DSP applications.
Prerequisites: ELEG 4053 (may be taken concurrently).

ELEG 4223 Electronic and Photonic Materials and Devices: 3 semester hours.
Properties of insulators, conductors, semiconductors, electro-optical and magnetic materials. Basic operation of opto-electronic devices and systems.
Prerequisites: ELEG 3033.

ELEG 4243 Power Electronics: 3 semester hours.
Characteristics of solid state power switches, controlled rectifiers and inverters; DC choppers; AC power controllers; applications to power supplies, electric machine drives, HVDC power transmission and space power systems.
Prerequisites: ELEG 3043 and ELEG 4013 (may be taken concurrently).

ELEG 4253 Computer Interfacing and Communications: 3 semester hours.
Microcontroller and microcomputer structures and applications; programming and design of hardware interfaces; emphasis on student projects.
Prerequisites: ELEG 3071 and ELEG 3073.

ELEG 4263 VLSI Circuit Design: 3 semester hours.
Analysis and design of monolithic integrated circuits, device modeling; CAD tools and computer-aided design, design methodologies of VLSI circuits.
Prerequisites: ELEG 3043 and ELEG 3063 and ELEG 4043 (may be taken concurrently).

ELEG 4273 Analog and Mixed Signal Techniques I: 3 semester hours.
Overview of analog and digital logic circuits, mixed signal circuits and systems, mixed signal test specification process, DC and parametric measurements, tester hardware, DSP-based testing, simulation and design techniques, power management circuits and systems.
Prerequisites: ELEG 3043 and ELEG 3063 and ELEG 4003 (may be taken concurrently).

ELEG 4283 Reliability Analysis of Electrical Facilities: 3 semester hours.
Overview of reliability and probabilistic theory, Monte Carlo simulations, preventive and predictive maintenance methodology, computerized maintenance management systems, generation, transmission and distribution networks and loads, field study and power deregulation.
Prerequisites: ELEG 4013 and MATH 3023.

ELEG 4291 Mixed Signal Testing Techniques Lab: 1 semester hour.
Mixed signal Measurements, Mixed signal Parameters Measurements, Signal sourcing Techniques, Signal capturing Techniques, Frequency Domain Measurements, DSP based testing, DAC testing, ADC testing, Template test and Analog Circuit Review.
Co-requisite: ELEG 4273.
ELEG 4293 Analog and Mixed Signal Techniques II: 3 semester hours.
Sampled channel testing. Focused calibrations, DAC testing, ADC testing, DIB design. Design for test (DFT), Data Analysis and Test Economics. Current issues relating to Mixed Signal Systems.
Prerequisites: ELEG 4273 (http://catalog.pvamu.edu/search/?P=ELEG%204273).

ELEG 4303 Introduction to Digital Design: 3 semester hours.
Prerequisites: ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063) and ELEG 3073 (http://catalog.pvamu.edu/search/?P=ELEG%203073).

ELEG 4311 Advanced Logic Design Laboratory: 1 semester hour.
Design and laboratory implementation of digital systems using standard, integrated circuits.
Prerequisites: ELEG 4353 (http://catalog.pvamu.edu/search/?P=ELEG%204353) (may be taken concurrently).

ELEG 4313 Broadband Communication Systems I: 3 semester hours.
Introduction to types of high-speed communication system (broadband), telephone subscriber loop environment, twisted-pair channel modeling, transceiver front-end noise models. Channel capacity testing and analysis techniques of XDSL systems. XDSL modulation techniques and deployment considerations.
Prerequisites: ELEG 3023 (http://catalog.pvamu.edu/search/?P=ELEG%203023).

ELEG 4321 Computer Network Laboratory: 1 semester hour.
Use of Linux. Shell and socket programming. Client and server operations, Wireshark software for performance monitoring, management and traffic parameters estimation, wireless local area network Address resolution protocol and troubleshooting. Internet protocols, routing, and fragmentation.
Prerequisites: ELEG 4333 (http://catalog.pvamu.edu/search/?P=ELEG%204333) (may be taken concurrently).

ELEG 4323 Broadband Communication Systems II: 3 semester hours.
Topics include Hybrid Circuits, Analog Front end precision issues, channel equalization, Echo cancellation, Error Correction and Trellis Coding. Varieties of Digital Subscriber Line (XDSL), testing issues relating to XDSLS. Standards and standard related issues with emphasis on Asymmetric Digital Subscriber Line.
Prerequisites: ELEG 4313 (http://catalog.pvamu.edu/search/?P=ELEG%204313).

ELEG 4333 Communication Network Engineering: 3 semester hours.
Multi-service applications: Voice/IP, Video on-demand and Video Conferencing. Physical layer design issues including the modulation, demodulation, synchronization, bandwidth, SNR, and interfaces. Link layer design including medium access control, error detection and retransmission strategies. Network routing strategies and transport layer functionality. Design of wired and wireless Local Area Networks based on IEEE 802.x standards. Design of INTERNET Architectures configured with network routing, and the use of network components such as routers, switches and hubs.
Prerequisites: ELEG 4303 (http://catalog.pvamu.edu/search/?P=ELEG%204303).

ELEG 4343 Microcontroller Applications: 3 semester hours.
Use and application of single chip microcontrollers in the design of instrumentation and control systems.
Prerequisites: ELEG 3043 (http://catalog.pvamu.edu/search/?P=ELEG%203043) and ELEG 4303 (http://catalog.pvamu.edu/search/?P=ELEG%204303).

ELEG 4353 Advanced Logic Design: 3 semester hours.
Introduction to the design, modeling and verification of complex digital system, modem design, methodologies for logic design, development of tools for the design and testing of digital systems.
Prerequisites: ELEG 3073 (http://catalog.pvamu.edu/search/?P=ELEG%203073).
Co-requisite: ELEG 4311 (http://catalog.pvamu.edu/search/?P=ELEG%204311).

ELEG 4393 Computer Organization and Design: 3 semester hours.
An introduction to computer organization using assembly and machine language. Number representation, computer arithmetic, instruction sets, I/O interrupts, and programming interrupts. Projects involve detailed study and use of a specific computer hardware and software system.
Prerequisites: ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063).

ELEG 4472 Senior Design and Professionalism I: 2 semester hours.
This is the first course of a two-semester capstone experience (ELEG 4482 (http://catalog.pvamu.edu/search/?P=ELEG%204482) must immediately follow ELEG 4472 (http://catalog.pvamu.edu/search/?P=ELEG%204472) or sequence must restart with 4472) involving engineering design of an industrial or advanced team project. Elements of ethics and professionalism in engineering practice are integrated into the project experience. The project will include application of relevant engineering codes and standards, as well as realistic constraints. Design achievements are demonstrated with written reports, and oral presentation, and professional standards and ethics examinations.
Prerequisites: CHEG 2003 (http://catalog.pvamu.edu/search/?P=CHEG%202003) and ELEG 3063 (http://catalog.pvamu.edu/search/?P=ELEG%203063) and ELEG 3043 (http://catalog.pvamu.edu/search/?P=ELEG%203043).
ELEG 4482 Senior Design and Professionalism II: 2 semester hours.
A continuation of ELEG 4472 (http://catalog.pvamu.edu/search/?P=ELEG%204472) with required design modifications of the team projects necessary to produce a working prototype of the designs initiated in Senior Design and Professionalism I. Results of the design are presented in a Design project deliverables including an oral presentation, a written report, and a formal, final oral presentation, as well as a final report. Professionalism education with demonstration of prototype, or a model of the design. Elements of professionalism reinforce the importance of professional engineering ethics, corporate culture, life-long learning, and globalization.
Prerequisites: ELEG 4472 (http://catalog.pvamu.edu/search/?P=ELEG%204472).

ELEG 4993 Independent Study: 1-3 semester hour.
Readings, research, and/or field work on selected topics.

ELEG 5913 Engineering Project: 3 semester hours.
An engineering design and analysis investigation at the master's level. Topic to be decided between student and advisor and should be relevant to students specialty area. A written project report is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

ELEG 5963 Electrical Engineering Research: 3 semester hours.
Methods and practice of Electrical Engineering research performed under the supervision of graduate advisor.

ELEG 5966 Research: 6 semester hours.
Engineering research under the supervision of graduate advisor.

ELEG 5993 Independent Study: 3 semester hours.
Reading, research, and/or field work on selected topics.

ELEG 5996 Thesis: 6 semester hours.
A candidate for the Master of Science in Electrical Engineering is required to perform a study, a design of investigation, under the direction of a faculty advisory committee. A written thesis is required to be presented, defended orally and submitted to the faculty advisory committee for approval.

ELEG 6011 Graduate Seminar I: 1 semester hour.
Seminar on emerging areas of electrical engineering. Research presentations by faculty, students and invited guests.

ELEG 6021 Graduate Seminar II: 1 semester hour.
Continuation of ELEG 6011 (http://catalog.pvamu.edu/search/?P=ELEG%206011).

ELEG 6103 Advanced Computer Systems Design: 3 semester hours.
Digital Design Methodologies, System Design CAD tools, Hardware Description Language, Simulation, Verification and Synthesis. Prerequisites: ELEG 4303 (http://catalog.pvamu.edu/search/?P=ELEG%204303).

ELEG 6113 Computer Architecture & Advanced Logic Design: 3 semester hours.
Overview of switching theory, logic design, combinatorial and sequential circuits, and FSMs. Computer architecture: organization and design with CPU, Memory, cache, VO, OS, DMA, MMU, operations of interrupt and. DMA, and performance analysis. Special architectures: Parallel architectures, microprogramming, RISC, and ASIC design overview. Prerequisites: ELEG 4303 (http://catalog.pvamu.edu/search/?P=ELEG%204303).

ELEG 6123 The Internet: Design and Implementation: 3 semester hours.
Overview of ISO Reference Model. Homogeneous, heterogeneous and ad-hoc network architectures. Reference Model of end-to-end networking: access networks, enterprise networks and core networks, internetworking issues and protocol architecture. Internet network elements and protocols including routers, switches, diffServe, MPLS, and VPN. Internet applications and Quality of Service issues. Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003) and ELEG 4303 (http://catalog.pvamu.edu/search/?P=ELEG%204303).

ELEG 6133 Fault Tolerant Computing: 3 semester hours.

ELEG 6143 Modeling and Performance of Computer Architectures: 3 semester hours.
Computer architecture overview, modeling and interconnecting hardware components. Qualitative and quantitative performance analysis and cost effectiveness for different computer design trade-offs. Advanced Processor designs including superscalar and out-of-order execution, advanced memory systems such as non-blocking caches and multi-porting/banking and alternative virtual memory implementations. Analysis of VO systems, interconnects, introduction to multiprocessor architectures, performance and cost metrics, and benchmarking. Prerequisites: ELEG 6113 (http://catalog.pvamu.edu/search/?P=ELEG%206113).

ELEG 6153 Information Networks: 3 semester hours.
ELEG 6203 Wireless Networks: 3 semester hours.
Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003).

ELEG 6213 Digital Communications: 3 semester hours.
Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003) and ELEG 6313 (http://catalog.pvamu.edu/search/?P=ELEG%206313).

ELEG 6223 Network Management: 3 semester hours.
Prerequisites: ELEG 6153 (http://catalog.pvamu.edu/search/?P=ELEG%206153).

ELEG 6233 Coding Theory: 3 semester hours.
Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003) and ELEG 6313 (http://catalog.pvamu.edu/search/?P=ELEG%206313).

ELEG 6243 Advanced Broadband Communications Systems: 3 semester hours.
Prerequisites: ELEG 4313 (http://catalog.pvamu.edu/search/?P=ELEG%204313).

ELEG 6253 Telecommunications Network Security: 3 semester hours.
Overview of cryptography. Public and private key encryption. Privacy, authentication, authorization and digital signatures, and Hash algorithms. Design of network security using private key encryption (DES) and public key encryption (RSA). Concept of electronic codebook and knowledge proof systems. Intrusion detection and active prevention and firewalls. Scrambling techniques for non-data signals such as voice and video. Security management design for networks.
Prerequisites: ELEG 6313 (http://catalog.pvamu.edu/search/?P=ELEG%206313).

ELEG 6303 Signal Detection and Estimation: 3 semester hours.
Statistical detection theory: signal and parameter estimation theory; likelihood-ratio decision rules; Bayesian probability, maximum-likelihood, maximum-a-posterior, Neyman-Pearson, and minimum-error criteria; Cramer-Rao Bound; unbiased estimators; Kalman and Wiener filters, estimators; simple and composite hypothesis testing, optimum linear filtering, smoothing and prediction, nonlinear estimation.
Prerequisites: ELEG 6313 (http://catalog.pvamu.edu/search/?P=ELEG%206313).

ELEG 6313 Stochastic Processes: 3 semester hours.
Prerequisites: MATH 3023 (http://catalog.pvamu.edu/search/?P=MATH%203023).

ELEG 6323 DSP Systems Design: 3 semester hours.
Overview of Digital filter structures and digital filter design. Digital Processing Architectures: Microprocessors, Programmable arrays, ASICs; design considerations and algorithmic implementations. Interface considerations and interoperability issues for hardware system. Embedded systems designs for DSP applications. Design and implementation of DSP algorithms and Performance considerations.
Prerequisites: ELEG 4053 (http://catalog.pvamu.edu/search/?P=ELEG%204053).
**ELEG 6333 Wavelets and Their Applications:** 3 semester hours.
Prerequisites: ELEG 4003 (http://catalog.pvamu.edu/search/?P=ELEG%204003) and ELEG 4053 (http://catalog.pvamu.edu/search/?P=ELEG%204053).

**ELEG 6343 Advanced Signals and Systems:** 3 semester hours.
Prerequisites: ELEG 3023 (http://catalog.pvamu.edu/search/?P=ELEG%203023) and ELEG 6313 (http://catalog.pvamu.edu/search/?P=ELEG%206313).

**ELEG 6353 Advanced Digital Signal Processing:** 3 semester hours.
Prerequisites: ELEG 4053 (http://catalog.pvamu.edu/search/?P=ELEG%204053).

**ELEG 6403 Solid State Devices:** 3 semester hours.
Development and analysis of solid state physics needed for quantitative modeling of electronic materials and solid state electronic devices and their characteristics; relationship of basic principles to measurable electrical characteristics, structure and material properties of electronic devices.
Prerequisites: ELEG 3033 (http://catalog.pvamu.edu/search/?P=ELEG%203033).

**ELEG 6413 Integrated Circuit Fabrication:** 3 semester hours.
Basic Integrated Circuit fabrication processes: crystal growth (thin film and bulk), thermal oxidation, dopant diffusion/implantation, thin film deposition/etching and lithography. Introduction to process and device simulators such as SUPREM and PISCES. Fabrication and characterization of resistors, MOS capacitors, junction diodes an MOSFET devices.
Prerequisites: ELEG 3033 (http://catalog.pvamu.edu/search/?P=ELEG%203033) and ELEG 4043 (http://catalog.pvamu.edu/search/?P=ELEG%204043).

**ELEG 6423 VLSI and ULSI Design:** 3 semester hours.
MOS transistor and characteristics, CMOS inverter and transmission gates. Design of complex CMOS gates; combinational and sequential design techniques in VLSI and ULSI; issues in static transmission gate and dynamic logic design; CMOS technology and layout design rules. Use of CAD tools to layout, check and simulate circuits. Design, layout and simulation of a small project.
Prerequisites: ELEG 3033 (http://catalog.pvamu.edu/search/?P=ELEG%203033) and ELEG 4033 (http://catalog.pvamu.edu/search/?P=ELEG%204033) and ELEG 4043 (http://catalog.pvamu.edu/search/?P=ELEG%204043).

**ELEG 6433 Semiconductor Devices:** 3 semester hours.
Operation and modeling of basic bipolar and unipolar semiconductor devices including p-n junctions, Schotky diodes, BJT, MOSFET and HEMTs; properties of semiconductor interfaces, particularly of MOS and MIS structures.
Prerequisites: ELEG 6403 (http://catalog.pvamu.edu/search/?P=ELEG%206403).

**ELEG 6503 Advanced Photonics Materials and Devices:** 3 semester hours.
Optical properties and processes in elemental and compound semiconductors; junction theory of homo- and hetero-junctions; theory and operation of various opto-electronic devices including light emitting diodes, laser diodes, photo detectors and solar cells; Opto-electronic modulation and switching; light transmission and integrated applications.
Prerequisites: ELEG 6403 (http://catalog.pvamu.edu/search/?P=ELEG%206403) and ELEG 6433 (http://catalog.pvamu.edu/search/?P=ELEG%206433).

**ELEG 6513 Advanced Quantum Devices:** 3 semester hours.
Selected topics in advanced concepts in quantum theory of semiconductors including transport theory; qualitative description of superconductivity and related devices, description and analysis of quantum and Nano-scale devices such as RTDs, Nano-tube transistors, SETs and molecular electronics, description of device fabrication techniques such as epitaxial growth, characterization of hetero-structures, quantum wells and super lattices including strained layers.
Prerequisites: ELEG 6403 (http://catalog.pvamu.edu/search/?P=ELEG%206403) and ELEG 6433 (http://catalog.pvamu.edu/search/?P=ELEG%206433).

**ELEG 6523 Advanced Characterization of Materials and Devices:** 3 semester hours.
The theory and application of state-of-the-art characterization techniques on advanced materials and devices; experimental techniques that describe the electronic, structural and thermal properties of materials. Emphasis will be placed on materials and devices that are current areas of research and development.
Prerequisites: ELEG 6403 (http://catalog.pvamu.edu/search/?P=ELEG%206403) and ELEG 6433 (http://catalog.pvamu.edu/search/?P=ELEG%206433).
ELEG 6533 Advanced VLSI Design: 3 semester hours.
Advanced topics in VLSI Design. Topics include: use of high level design, synthesis and simulation tools, design for testability, clock distribution and routing problems, synchronous circuits, low power design techniques, study of various VLSI-based computations. Discussion on current research topics in VLSI design.
Prerequisites: ELEG 6423.

ELEG 6543 Advanced Solid State: 3 semester hours.
This course will be a survey of selected topics in areas of solid state devices that are in the research and development stage. Topics will include new material systems, new methods for fabrication and processing microelectronics, new device structures and architectures for integrated circuits, new reliable neutron detectors for large-scale integration of the next generation devices.
Prerequisites: ELEG 6403 and ELEG 6433.

ELEG 6553 Advanced Mixed Signal Design: 3 semester hours.
Advanced study of Analog signal processing families, discrete time switched capacitor circuits, NO and DI A converters, samples, modulators, oscillators, and system level circuit design. In-depth theoretical treatment of mixed signal system design and testing systems for achievable mixed signal system performance. Exploration of current techniques for Mixed Signal system testing.
Prerequisites: ELEG 4043 and ELEG 4273.

ELEG 6713 Power System Faults Protective: 3 semester hours.
Calculation of power system currents and voltages during faults; protective relaying principles, application and response to system faults. Characteristics of protection components. Prerequisite: approval of instructor. This course is repeatable up to 6 semester hours.

ELEG 6723 Power System Stability: 3 semester hours.
Modeling of the transmission system, loads, generators, excites, and governors; prefault and postfault conditions; effect of system protection schemes on stability computational aspects of load-flow solutions; system security considerations. Writing programs for state-by-state analysis and Monte Carlo power system analysis. Steady-state, dynamic and transient stability of power systems; solution techniques; effect of generator control systems.

ELEG 6733 High Voltage Direct Current: 3 semester hours.
Overview of HVDC systems; comparisons of AC and DC power transmission; study of six-pulse and twelve-pulse power converters; analysis and control of HVDC systems; harmonics and power factor effects; systems faults and mis-operations; state of the art and future developments in HVDC technology; inspection trips.

ELEG 6743 Power Gen Oper Control: 3 semester hours.

ELEG 6753 Advanced Power System: 3 semester hours.
Economic Dispatch. Solving sets of equations that involve large sparse matrices. Sparse matrix storage, ordering schemes, application to power flow analysis, short circuit calculation, power system planning and operation.

ELEG 6763 Power Electronics Power System: 3 semester hours.

ELEG 6773 Advanced Electric Drives: 3 semester hours.

ELEG 6783 Advanced Power Electronics: 3 semester hours.
Physics of solid-state power devices, passive components, magnetic optimization, advanced topologies. Unity power factor correction circuits, EMI issues, snubbers, soft switching in dc/ac converters. Very low voltage output converters. Integrated computer simulations.

ELEG 6913 Special Topics in Elec Engr: 3 semester hours.
Special topics in electrical engineering relating electrical energy, digital systems, communications, sign processing, and nanoelectronics are selected and discussed in detail. May be repeated for credit if topics vary.

ELEG 7016 Doctoral Research I: 6 semester hours.
Research for thesis or dissertation. Limited to doctoral students. May be repeated for credit.

ELEG 7026 Doctoral Research II: 6 semester hours.
Continuation of ELEG 7016. Limited to doctoral students. May be repeated for credit.

ELEG 7103 Advanced Topics in Computer Engineering: 3 semester hours.
Current research issues in computer architecture, digital design, networked-computing, embedded and real-time systems. May be repeated for credit when the topics vary.

ELEG 7123 Advanced Topics in Telecommunications and Signal Processing: 3 semester hours.
Current research issues in telecommunications and digital signal processing. May be repeated for credit when the topics vary.
ELEG 7133 Advanced Topics in Microelectronics: 3 semester hours.
Current research issues in the design, fabrication, characterization and reliability of integrated circuits. May be repeated for credit when the topics vary.

ELEG 7916 Doctoral Dissertation I: 6 semester hours.
The continuation of ELEG 7016 (http://catalog.pvamu.edu/search/?P=ELEG%207016) and ELEG 7026 (http://catalog.pvamu.edu/search/?P=ELEG%207026) for writing thesis. Limited to students who have been admitted to candidacy for the doctoral degree. May be repeated for credit.

ELEG 7926 Doctoral Dissertation II: 6 semester hours.
Continuation of ELEG 7916 (http://catalog.pvamu.edu/search/?P=ELEG%207016). Limited to students who have been admitted to candidacy for the doctoral degree. May be repeated for credit.