Electrical Engineering, M.S.E.E., Ph.D.

Degrees Offered

- Masters of Science, Electrical Engineering (M.S.E.E.)
- Doctor of Philosophy, Electrical Engineering (Ph.D.)

Nature of the Program

The Masters of Science in Electrical Engineering (M.S.E.E.) degree program is intended for students who have an undergraduate degree in Electrical Engineering, Computer Engineering, or a closely related discipline, and wish to broaden their depth of understanding in one or more areas of the field. Program graduates will be qualified to pursue careers in industry, government, or further academic study. The Doctor of Philosophy program should be considered by those with superior academic achievement and who desire to pursue a career of research or teaching.

Masters Program Educational Objectives & Outcomes

The objective of the Master of Science in Electrical Engineering (M.S.E.E.) degree program is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, government service, or in further graduate or professional study.

Specific outcomes that will be achieved by graduates of the program are:

1. Achieve a depth of proficiency in a specific field of Electrical Engineering by completing major courses in one of four areas: electronics and photonics; systems and signals; computer systems; or software and knowledge engineering.
2. Achieve a breadth of understanding of Electrical Engineering by completing minor coursework requirements in another area, and by participation in graduate seminar requirements.
3. Demonstrate professionalism and communication skills through completion of coursework, project or thesis defense.

Doctoral Program Educational Objectives & Outcomes

The objective of the Ph.D. Program in Electrical Engineering degree program is to produce graduates who have the knowledge, skills, and attitudes that will ensure success in professional positions in business, industry, research, government service, or in further graduate or professional study.

Specific outcomes that will be achieved by graduates of the program are:

1. Achieve a depth of understanding in Electrical Engineering, as demonstrated by completion of core Ph.D. courses and examination on that material through the Qualifying Examination process.
2. Achieve a breadth of understanding of the Electrical Engineering discipline, as demonstrated by completion of remaining doctoral coursework and participation in graduate seminar.
3. Demonstrate the ability to conduct independent research by completion and defense of a dissertation.

Admissions

All Masters and Ph.D. programs require applicants to provide the items below to be considered for admission:

- A minimum cumulative grade point average of 3.0 or equivalent, based on a 4.0 scale.
- Three letters of reference.
- All graduate degree programs require the GRE general test, with a suggested score of either the 80th percentile on the quantitative part or 80th percentile total (verbal + quantitative + analytical).
- All graduate degree programs require an appropriate bachelors or master's degree for entry. Students lacking some foundation courses appropriate to a particular degree program may be assigned some preparatory coursework as a condition of admission.
- International applicants must meet the WVU requirement of English language proficiency ([https://graduateadmissions.wvu.edu/how-to-apply/apply-for-2022-2023/international-graduate-applicant/](https://graduateadmissions.wvu.edu/how-to-apply/apply-for-2022-2023/international-graduate-applicant/)).

FOUNDATION ASSESSMENT

Prior to the first week of classes, new Ph.D. students must meet with the graduate coordinator to select classes. This interview determines if the student needs preparatory work in order to pursue a graduate degree. Students with deficiencies may be required to take courses as prerequisites for graduate courses. Deficiencies are usually noted as a condition for admission. However, they may also be specified during the interview or later.

During the first semester, students must form their Advisory and Examining Committee (AEC) and write a plan of study. The AEC may also identify additional deficiencies to be removed, but this is rare since deficiencies should have been identified earlier in the student’s career.
Admission Requirements 2023-2024
The Admission Requirements above will be the same for the 2023-2024 Academic Year.

MSEE Major Code: 3025
PhD Major Code: 3026

For specific information on the following programs, please see the links to the right:

• Electrical Engineering, M.S.E.E.

For specific information on the following programs, please see the links to the right:

• Electrical Engineering, Ph.D.

COURSES

EE 513. Stochastic Systems Theory. 3 Hours.

EE 515. Linear Control Systems. 3 Hours.
PR: Consent. Basic concepts in the theory of linear control systems, state variable representation, solution of state equations, controllability, observability, stability, transfer function descriptions, and design of controllers and observers. (3 hr. rec.).

EE 517. Optimal Control. 3 Hours.
PR: Consent. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin’s maximum principle; dynamic programming; adaptive feedback systems. (3 hr. rec.).

EE 528. Biomedical Microdevices. 3 Hours.
Fundamentals of micro-manufacturing and micro-fluidics, microfluidic platforms and components, biosensors, drug-delivery systems, lab-on-a-chip devices, DNA microarrays, emerging applications in biomedicine and tissue engineering, and photolithography and soft lithography lab demonstration.

EE 531. Advanced Electrical Machinery. 3 Hours.
PR: Consent. Theory and modeling of synchronous, induction, and direct-current machines, and their steady-state and transient analysis. (3 hr. rec.).

EE 533. Computer Applications in Power System Analysis. 3 Hours.
PR: EE 436 or Consent. Steady state analysis by digital computers of large integrated electrical power systems. Bus admittance and impedance matrices, load flow studies, economic dispatch and optimal power flow, steady state security analysis, and fault studies. (3 hr. rec.).

EE 535. Power System Control and Stability. 3 Hours.
PR: EE 515. Review of stability theory, classical transient analysis, dynamical models of synchronous machines, power system stability under small and large perturbations, dynamic, and simulation of power systems. (3 hr. rec.).

EE 550. Advanced Semiconductor Electronics. 3 Hours.

EE 551. Linear Integrated Circuits. 3 Hours.
PR: EE 355 and EE 356 and EE 450 or equivalent. Design and analysis of analog integrated circuits. Both linear and nonlinear transistor models are covered. Applications focus on linear analog circuits including simple amplifiers, operational amplifiers, and reference circuits. This course focuses on CMOS technology.

EE 561. Communication Theory. 3 Hours.
PR: EE 461 or Consent. Detailed study of probability theory and its use in describing random variables and stochastic processes. Emphasis on applications to problems in communication system design. (3 hr. rec.).

EE 562. Wireless Communication System. 3 Hours.
PR: EE 461 and EE 513. Architecture and design of cellular and wireless communication networks, electromagnetic effects of the wireless channel and corresponding statistical models, implementation and performance of diversity reception techniques, and multiple-access.

EE 564. Digital Signal Processing for Radio Astronomy. 3 Hours.
PR: Graduate Standing and/or consent. Digital signal processing as applied to radio astronomy. Filtering, Fourier transforms and correlation firmware are designed for Field Programmable Gate Arrays.

EE 565. Advanced Image Processing. 3 Hours.
PR: EE 465 or equivalent. Covers the theory of statistically modeling image source, algorithms for analysis and processing of image signals, new applications of image processing into computer vision and biomedical imaging, and MATLAB based image processing.

EE 567. Coding Theory. 3 Hours.
PR: MATH 375 or consent. Design, analysis, and implementation of codes for error detection and correction.
EE 569. Digital Video Processing. 3 Hours.
PR: EE 465. Covers basic theory and algorithmic aspects of digital video processing, along with latest video coding standards, multimedia streaming, security video, and biometrics. Hands-on experience in processing video signals under MATLAB in team-based projects.

EE 591L-V. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

EE 593. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

EE 595. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

EE 613. Detection and Estimation Theory. 3 Hours.

EE 650. Optoelectronics. 3 Hours.
PR: EE 450 or PHYS 471 or consent. Semiconductor physics theory of light-emitting diodes, homojunction lasers, single and double heterojunction lasers, separate confinement quantum well lasers, p-i-n and photodetectors and avalanche photodetectors. Optical and electrical analysis of epitaxial and device designs.

EE 668. Information Theory. 3 Hours.
PR: EE 513. Mathematical description of channels and sources; entropy, information, data compression, channel capacity, Shannon’s theorems, rate-distortion theory, maximum entropy principle, and large deviations theory.

EE 689. Graduate Internship. 1-3 Hours.
PR: Completion of a minimum of 18 degree applicable graduate credit hours with a minimum GPA of 3.0 or better. Employment in industry related to degree program. (Graded P/F. May be repeated twice. Cannot be counted toward graduation requirements.).

EE 691. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

EE 692. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

EE 695. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

EE 697. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).

EE 699. Graduate Colloquium. 1-6 Hours.
PR: Consent. Graduate students not seeking coursework credit but who wish to meet residency requirements, use the University’s facilities, and participate in its academic and cultural programs. Note: Graduate students who are not actively involved in coursework or research are entitled, through enrollment in their department’s 699/799 Graduate Colloquium to consult with graduate faculty, participate in both formal and informal academic activities sponsored by their program, and retain all of the rights and privileges of duly enrolled students. Grading is S/U: colloquium credit may not be counted against credit requirements for masters programs. Registration for one credit of 699/799 graduate colloquium satisfies the University requirement of registration in the semester in which graduation occurs.

EE 713. Large-Scale System Modeling. 3 Hours.
PR: EE 515. Characterization of large-scale systems, model simplification through aggregation and perturbation methods, optimal and chained aggregation, balanced realization and cost component procedures, optimal model reduction, simplification effects, decentralized control, and feasibility and design. (3 hr. lec.).

EE 731. Real Time Control of Power System. 3 Hours.
PR: EE 515 and EE 517 and EE 533. Application of computers to modern control theory for reliable and economic real-time operation of integrated power systems. (3 hr. rec.).

EE 733. Protection of Power Systems. 3 Hours.
PR: EE 436 or Consent. Principles of relay protection for faults on transmission lines and other devices. Use of overcurrent, differential distance, and pilot relaying systems. Special relay applications. Determination of short-circuit currents and voltages from system studies. (3 hr. rec.).

EE 735. HVDC Transmission. 3 Hours.
PR: EE 435 and EE 533. Line-commutated converter analysis, operation of two terminal and multiterminal dc systems, harmonics and filters, modeling of ac/dc system, and design of modulation controllers.

EE 790. Teaching Practicum. 1-3 Hours.
PR: Consent. Supervised practice in college teaching of electrical engineering. Note: This course is intended to insure that graduate assistants are adequately prepared and supervised when they are given college teaching responsibility. It will also present a mechanism for students not on assistantships to gain teaching experience. (Grading will be S/U.).
EE 791. Advanced Topics. 1-6 Hours.
PR: Consent. Investigation of advanced topics not covered in regularly scheduled courses.

EE 792. Directed Study. 1-6 Hours.
Directed study, reading, and/or research.

EE 793. Special Topics. 1-6 Hours.
A study of contemporary topics selected from recent developments in the field.

EE 795. Independent Study. 1-9 Hours.
Faculty supervised study of topics not available through regular course offerings.

EE 796. Graduate Seminar. 1-3 Hours.
PR: Consent. Each graduate student will present at least one seminar to the assembled faculty and graduate student body of his or her program.

EE 797. Research. 1-9 Hours.
PR: Consent. Research activities leading to thesis, problem report, research paper or equivalent scholarly project, or a dissertation. (Grading may be S/U.).