ELECTRICAL ENGINEERING (EE)

EE F102  Introduction to Electrical and Computer Engineering
3 Credits
Offered Spring
Basic modern devices, concepts, technical skills and instruments of electrical engineering.
Prerequisite: MATH F251X (may be taken concurrently).
Lecture + Lab + Other: 2 + 3 + 0

EE F203  Electric Circuits
4 Credits
Offered Fall
Introduces DC and AC circuit analysis techniques including transient analysis, steady state analysis, three phase circuits and ideal amplifiers.
Prerequisites: MATH F251X; MATH F252X (may be taken concurrently); EE F102.
Lecture + Lab + Other: 3 + 3 + 0

EE F204  Electrical Engineering Fundamentals II
4 Credits
Offered Spring
Electronics of solid state devices, amplifier design, digital circuits, electromechanics, control systems and instrumentation.
Prerequisites: MATH F253X (may be taken concurrently); EE F203; MATH F252X.
Lecture + Lab + Other: 3 + 3 + 0

EE F254  Unmanned Aircraft Systems (UAS) Investigation
3 Credits
Offered As Demand Warrants
Course provides an introductory analysis of unmanned air systems (UAS), including typical missions and performance expectations for various classes of UAS. Students will investigate subsystem choices for a UAS and how these affect mission performance. Course includes discussion of external factors impacting UAS design choices, including support infrastructure, flight operations and data requirements.
Crosslisted with ME F254.
Lecture + Lab + Other: 3 + 0 + 0

EE F256  Unmanned Aircraft Systems (UAS) Design
3 Credits
Offered As Demand Warrants
A multidisciplinary team of students will design, build, test and deliver an unmanned aircraft system (UAS) in support of university research mission requirements. Students will learn basic concepts related to the systems engineering design process. Graded events include team briefings, written reports, multimedia products and a finished UAS product.
Prerequisites: EE/ME F254.
Crosslisted with CS F254, ME F256.
Lecture + Lab + Other: 3 + 0 + 0

EE F258  Unmanned Aircraft Systems (UAS) Operations
3 Credits
Offered As Demand Warrants
Covers the use of unmanned aircraft systems (UAS), sensors, and support infrastructure required to conduct a selected mission set. Emphasis is on mission analysis, planning, and conduct, including definition of requirements/constraints, identification of appropriate assets, flight planning considerations, and data analysis requirements. Teams coordinate resources for mission and report results.
Cross-listed with CS F258; GEOS F258; and ME F258.
Lecture + Lab + Other: 3 + 0 + 0

EE F301  Analytical Methods for Electrical and Computer Engineers
3 Credits
Offered Fall
Discipline-specific analytical methods used in the electrical and computer engineering core subjects. Topics include matrix algebra, eigenanalysis, vector spaces, complex analysis, discrete structures, and probability and statistics with examples from the electrical and computer engineering fields.
Prerequisites: MATH F252X.
Lecture + Lab + Other: 3 + 0 + 0

EE F303  Electrical Machinery
4 Credits
Offered Fall
Electromechanical energy conversion principles, characteristics and applications of transformers, synchronous and induction machines, DC machines, and special machines.
Prerequisites: EE F204.
Lecture + Lab + Other: 3 + 3 + 0

EE F311  Engineering Electromagnetics I
3 Credits
Offered Fall
Electromagnetic theory and applications. Static electric fields in free space and material media; steady current systems and associated magnetic effects. Includes electrostatics, magnetostatics, Maxwell’s equations, electromagnetic wave propagation, and transmission lines. Application of the wave equations to engineering systems.
Prerequisites: MATH F302 (may be taken concurrently); EE F204; MATH F253X; PHYS F212X.
Lecture + Lab + Other: 3 + 0 + 0

EE F331  High-frequency Lab
1 Credit
Offered Fall
Laboratory experiments in transmission lines, impedances, bridges, scattering parameters, hybrids and waveguides.
Prerequisite: EE F311.
Lecture + Lab + Other: 0 + 3 + 0

EE F333  Electronic Devices (W)
4 Credits
Offered Fall
An introduction to the properties of semiconductors and the analysis of electronics and electrical devices including diodes, field effect transistors (FETs), bipolar junction transistors (BJTs). Large signal and small signal analysis techniques, and common electrical circuit topologies.
Prerequisites: EE F204; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X.
Lecture + Lab + Other: 3 + 3 + 0
EE F334  Electronic Circuit Design  
4 Credits  
Offered Spring  
Application of semiconductor devices in circuit design in computation, automatic control and communication.  
Prerequisites: EE F333.  
Lecture + Lab + Other: 3 + 3 + 0  

EE F341  Digital and Computer Analysis and Design  
4 Credits  
Offered Fall  
Modular structure of computer systems. Analysis, design and implementation of combinational and sequential logic machines. Introduction to microprocessor architecture and microprocessor programming. Design with traditional and hardware description language techniques.  
Prerequisites: CS F201; one year of college physics.  
Lecture + Lab + Other: 3 + 3 + 0  

EE F343  Digital Systems Analysis and Design  
4 Credits  
Offered Fall  
Fundamental principles and practices of digital design. Analysis, design and implementation of combinational and sequential logic machines. Introduction to microprocessor architecture and microprocessor programming. Analysis of digital data transmission techniques and microprocessor interfacing. Design with traditional and hardware description language techniques. Implementation with both medium and large scale integrated (M/LSI) chips and programmable logic devices (PLDs).  
Prerequisites: ES F201 or CS F201; EE F204; EE F333 (may be taken concurrently).  
Lecture + Lab + Other: 3 + 3 + 0  

EE F353  Circuit Theory  
3 Credits  
Offered Fall  
Transfer functions, passive and active filters, Laplace transforms and applications, introduction to Fourier series and transforms and two port networks.  
Prerequisites: MATH F302 (may be taken concurrently); EE F204; ES F201 or CS F201; MATH F253X.  
Lecture + Lab + Other: 3 + 0 + 0  

EE F354  Engineering Signal Analysis  
3 Credits  
Offered Spring  
Prerequisites: EE F353; MATH F302.  
Lecture + Lab + Other: 3 + 0 + 0  

EE F404  Electrical Power Systems  
4 Credits  
Offered Spring  
Electrical power transmission and distribution systems, power flow, economic dispatch with computer-aided analysis, and smart grids.  
Prerequisites: EE F303.  
Lecture + Lab + Other: 3 + 3 + 0  

EE F406  Electrical Power Engineering  
4 Credits  
Offered Fall  
Symmetrical and unsymmetrical power system faults, power system protection and relaying, and dynamic power system stability with computer-aided fault and transient stability analysis.  
Prerequisites: EE F404.  
Lecture + Lab + Other: 3 + 3 + 0  

EE F408  Power Electronics Design  
(O, W)  
4 Credits  
Offered Spring  
Analysis and design of power electronic conversion, control and drive systems. Topics will include the theory and application of rectifiers, DC-DC converters, inverters, switches and regulators, power supplies and variable-frequency drives. Includes laboratory exercises using power electronic converter boards, PSPICE and a complete power electronics design project.  
Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; COJO F131X or COJO F141X; EE F303; EE F334; EE F354; senior standing.  
Stacked with EE F608.  
Lecture + Lab + Other: 3 + 3 + 0  

EE F412  Engineering Electromagnetics II  
3 Credits  
Offered Spring  
Use of Maxwell’s equations in analysis of plane wave propagation, wave reflection, radiation and antennas, waveguides, cavity resonators, transmission lines and radio propagation.  
Prerequisites: EE F311; EE F331; MATH F302.  
Lecture + Lab + Other: 3 + 0 + 0  

EE F432  Electromagnetics Laboratory  
1 Credit  
Offered Spring  
Laboratory experiments with microwave sources, propagating electromagnetic waves, waveguides and antennas. Design, construction and testing of antenna systems.  
Corequisites: EE F412.  
Lecture + Lab + Other: 0 + 3 + 0  

EE F443  Computer Engineering Analysis and Design  
4 Credits  
Offered Spring  
Advanced digital design, and principles and practices of computer engineering. Analysis and design of computer architecture and organization. Digital signal processing techniques and hardware. Microprocessor operation, control and interfacing. Design with traditional and hardware description language techniques. Implementation with both medium and large scale integrated chips and programmable logic devices.  
Prerequisites: EE F341 or EE F343.  
Lecture + Lab + Other: 3 + 3 + 0
EE F444  Embedded Systems Design  
Offered Spring  
Issues surrounding design and implementation of microcontroller-based embedded systems. Topics include hardware architecture and glue logic, embedded programs design, analysis, and optimization, hardware/firmware partitioning, firmware architecture and design. Includes laboratory exercises using evaluation board and a complete embedded system design project. Emphasis on robust designs, energy efficiency, and proper documentation.  
Prerequisites: COJO F131X or COJO F141X; EE F343 or EE F341; EE F354; EE F443; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing.  
Recommended: CS F301.  
Stacked with EE F645.  
Lecture + Lab + Other: 3 + 3 + 0  
EE F461  Communication Systems  
Offered Fall  
Theory, design and implementation of communication systems. Measurement of modulation, noise, channel spectrum, satellite link budget and microwave path design.  
Prerequisites: EE F354; senior standing.  
Lecture + Lab + Other: 3 + 3 + 0  
EE F463  Communication Networks  
Offered Spring  
Prerequisites: EE F354 and Senior standing.  
Lecture + Lab + Other: 3 + 0 + 0  
EE F464  Communication Networks Design  
Offered Spring  
Prerequisites: COJO F131X or COJO F141X; EE F354; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing.  
Lecture + Lab + Other: 3 + 3 + 0  
EE F471  Automatic Control  
Offered Spring  
Prerequisites: EE F353; MATH F302.  
Lecture + Lab + Other: 3 + 0 + 0  
EE F488  Undergraduate Research  
Offered Fall, Spring and Summer  
Advanced research topics from outside the usual undergraduate requirements.  
Prerequisites: Permission of instructor.  
Recommended: A substantial level of technical/scientific background.  
Lecture + Lab + Other: 0 + 0 + 0  
EE F508  Power Electronics Design  
Offered Spring  
Analysis and design of power electronic conversion, control and drive systems. Topics will include the theory and application of rectifiers, DC-DC converters, inverters, switches and regulators, power supplies and variable-frequency drives. Includes laboratory exercises using power electronic converter boards, PSPICE and a complete power electronics design project.  
Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; COJO F131X or COJO F141X; EE F303; EE F334; EE F354; senior standing.  
Stacked with EE F408.  
Lecture + Lab + Other: 3 + 3 + 0  
EE F609  Renewable and Sustainable Energy Systems  
Offered As Demand Warrants  
Study of renewable energy systems focusing on grid integration of wind turbine generators, solar photovoltaics, geothermal, biomass, hydroelectric, hydrokineatics, and energy storage. Design and analysis for efficient, sustainable, reliable, and resilient grid operation with distributed renewable energy sources considering cogeneration, controls optimization, economic dispatch, emissions, interruptible loads, and waste-heat recovery.  
Prerequisites: EE F303.  
Lecture + Lab + Other: 3 + 0 + 0  
EE F611  Waves  
Offered As Demand Warrants  
Introduction to waves and wave phenomena. Includes electromagnetic, acoustic, seismic, atmospheric and water waves and their mathematical and physical treatment in terms of Hamilton's principle. Discusses propagation, attenuation, reflection, refraction, surface and laminar guiding, dispersion, energy density, power flow, and phase and group velocities. Treatment limited to plane harmonic waves in isotropic media.  
Prerequisites: MATH F302 or MATH F432.  
Lecture + Lab + Other: 3 + 0 + 0
EE F634  Microwave Design I
3 Credits
Offered As Demand Warrants
Analysis, design, fabrication and measurement of passive microwave components and circuits using microstrip construction techniques. Theoretical and computer-aided design of transmission lines, power dividers, hybrids, directional couplers and filters.
Prerequisites: EE F334; EE F412; EE F432.
Lecture + Lab + Other: 2 + 3 + 0

EE F635  Microwave Design II
3 Credits
Offered As Demand Warrants
Analysis and design of solid-state microwave circuits. Amplifier and oscillator circuits are designed and fabricated using microstrip construction techniques and computer-aided design tools.
Prerequisites: EE F634.
Lecture + Lab + Other: 2 + 3 + 0

EE F643  Advanced Architectures for Parallel Computing
3 Credits
Offered As Demand Warrants
This course covers massively parallel computer architectures and their application for computationally intensive engineering problems. Fundamental hardware concepts and issues in designing such systems are introduced. Compute Unified Device Architecture (CUDA), developed by NVIDIA for the compute engines in their graphic processing units (GPUs), will be used as an example and a practical platform for student assignments. Through assignments and a project students will learn simulation, computational engineering, convolution, correlation, filtering, and similar problems of particular interest to engineering students.
Prerequisites: CS F201 or ES F201; EE F443 graduate standing.
Lecture + Lab + Other: 3 + 0 + 0

EE F645  Embedded Systems Design
4 Credits
Offered Spring
Issues surrounding design and implementation of microcontroller-based embedded systems. Topics include hardware architecture and glue logic, embedded programs design, analysis, and optimization, hardware/firmware partitioning, firmware architecture and design. Includes laboratory exercises using evaluation board and a complete embedded system design project. Emphasis on robust designs, energy efficiency, and proper documentation.
Prerequisites: Graduate standing.
Stacked with EE F444.
Lecture + Lab + Other: 3 + 3 + 0

EE F646  Wireless Sensor Networks
3 Credits
Offered As Demand Warrants
The course will survey the area of networked sensors, with a special focus on low-power wireless sensor networks. Topics covered will include communication standards and protocols for sensor networks, embedded operating systems, applications, collaborative processing, data fusion, and system architecture. Students will undertake a theoretical or practical research project.
Prerequisites: CS F201 or ES F201; EE F343 or EE F341; graduate standing.
Lecture + Lab + Other: 3 + 0 + 0

EE F647  Data Compression
3 Credits
Offered As Demand Warrants
Study of algorithms and techniques that reduce information storage and transmission requirements. Both lossless and lossy techniques will be studied including: Huffman coding, arithmetic coding, image compression, and transform techniques.
Prerequisites: ES F201 or CS F201.
Lecture + Lab + Other: 3 + 0 + 0

EE F648  VLSI Design
3 Credits
Offered As Demand Warrants
Study of methods to integrate millions of transistors on a single chip and create optimized design. Topics include CMOS logic design, power and timing issues. VLSI architectures, and full custom layout. Students will use CAD tools to implement a VLSI design.
Prerequisite: EE F343.
Lecture + Lab + Other: 3 + 0 + 0

EE F651  Digital Signal Processing
4 Credits
Offered Fall
Time, frequency and Z-transformation domain analysis of discrete time systems and signals; discrete Fourier transformation (DFT) and FFT implementations; FIR/IIR filter design and implementation techniques; discrete time random signals and noise analysis; quantization and round off errors; and spectral analysis. Includes applications to medical, speech, electromagnetic and acoustic signal analysis.
Prerequisites: Graduate standing.
Stacked with EE F451.
Lecture + Lab + Other: 3 + 3 + 0

EE F654  UAS Systems Design
3 Credits
Offered As Demand Warrants
Course covers the analysis of unmanned air vehicle subsystems, including support infrastructure elements comprising an unmanned air system. Course contains mission planning considerations, including flight planning and data requirements. Focus is on remote sensing missions which may be accomplished by appropriate UAS. Students participate in a UAS design/build/ fly workshop.
Prerequisites: Graduate Standing.
Lecture + Lab + Other: 3 + 0 + 0

EE F655  Adaptive Filters
3 Credits
Offered As Demand Warrants
Study to self-designing filters which recursively update depending on the statistics of the input data for optimum performance. Topics will include foundational material in probability of stochastic processes, spectral analysis, linear optimum filtering. Wiener-Hopf filters, Yule-Walker equations, forward and backward linear predictors, method of steepest descent, least squares techniques, and auto- regressive filters.
Prerequisites: EE F451.
Lecture + Lab + Other: 3 + 0 + 0
EE F656  Aerospace Systems Engineering
3 Credits
Offered As Demand Warrants
A multidisciplinary team of students will perform a preliminary design study of a major aerospace system. Design considerations will include requirements for project management, aerospace vehicle design, power, attitude control, thermal control, communications, computer control and data handling. The students will present their final design in a written report and a public seminar.
Prerequisites: Graduate standing.
Cross-listed with ME F656.
Lecture + Lab + Other: 3 + 0 + 0

EE F658  Unmanned Aircraft Systems (UAS) Operations
3 Credits
Offered Spring
This course covers the application of unmanned aircraft systems (UAS) to satisfy real-world scientific research or public service missions. Students will analyze mission requirements and recommend appropriate UAS vehicles, subsystems, sensors and data analysis tools needed to accomplish a specified mission. Students will design the UAS package, conduct a representative UAS mission, produce required data products and present their mission results to the user. Emphasis is on mission planning considerations, UAS/sensor capabilities, flight planning and data collection requirements.
Prerequisites: Graduate standing.
Cross-listed with CS F658.
Lecture + Lab + Other: 3 + 0 + 0

EE F662  Digital Communication Theory
3 Credits
Offered As Demand Warrants
Probability in communication systems, power spectral density, baseband formatting, bandpass modulation and demodulation, link analysis, coding and channel models. Sections of this course offered in Anchorage have an additional fee.
Prerequisites: EE F461.
Lecture + Lab + Other: 3 + 0 + 0

EE F671  Digital Control Systems
3 Credits
Offered As Demand Warrants
Study of digital control theory. Topics will include signal conversion, Z-transforms, state variable techniques, stability, time and frequency domain analysis and system design.
Prerequisites: EE F471.
Lecture + Lab + Other: 3 + 0 + 0

EE F698  Non-thesis Research/Project
1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

EE F699  Thesis
1-12 Credits
Lecture + Lab + Other: 0 + 0 + 0