Electrical Technology

ET101 Technical Electricity 1   Cr-3
This introductory course provides the basic knowledge and skills necessary within any electrical service technician program. It includes an in-depth study of electron theory, Ohm's Law, series and parallel circuits, as well as electrical energy and power relationships. Also included are methods of generation of electromotive force, electromagnetism, and motor principles and capacitance as these apply to DC circuits. Uses, construction, and calibration of voltmeters and ammeters are investigated. Corequisite: MA105 Technical Mathematics 1.

ET102 Technical Electricity 2   Cr-3
This course is a continuation of ET101 Technical Electricity 1. It reinforces previously acquired information and applies it to alternating current (AC) circuits. It investigates AC sine wave generation, mutual inductance inductive and capacitive reactance, and instantaneous values of voltage and current as well as real and apparent power. Uses, construction, and calibration of AC metering equipment are an integral part of this course. Practical application of each topic in both introductory courses are included in all laboratory experiments. Prerequisite: ET101 Technical Electricity 1.

ET103 Technical Electronics   Cr-3.5
This course investigates the fundamental properties of semiconductor materials and the utilization of these materials in devices such as diodes, bi-polar transistors, field effect transistors, thyristors, and common substrated integrated circuits. Experiments pertain to various rectifiers, voltage regulators and elementary amplifier circuits. Emphasis is placed on constructing, troubleshooting, modifying, and repairing those circuits considered fundamental to the operation of electronic equipment. Prerequisites: ET101 Technical Electricity 1 OR ET111 Electrical Systems and MA105 Technical Mathematics 1.

ET104 Systems Diagrams   Cr-3
This course covers the types, application, and use of electrical/electronic drawings. It includes schematic diagrams and symbols as well as the operation of electro-mechanical devices. The course differentiates between schematics and wiring diagrams. It develops the use of block diagrams, schematics, ladder-logic diagrams, wiring diagrams, assembly drawings, and bills of material. Topics include Programmable Logic Controllers (PLCs), Basic Relay PLC Instructions, PLC Timers and Counters, and PLC programs in the form of PLC ladder diagrams. Corequisite: ET102 Technical Electricity 2.

ET105 Computer Control Fundamentals   Cr-2
This introductory course covers the personal computer and its software for electrical service technicians. It includes a survey of fundamental personal computer hardware: the keyboard, microprocessor, mouse, disk drives, and printers. It introduces DOS and Windows operating systems and hands-on experience with software packages such as word processing and spreadsheets. It concludes with an introduction to BASIC, which is used to solve practical problems in the electrical/electronic field. (Fall Semester)

ET108 Refrigeration 1   Cr-4
This course covers basic physics as applied to refrigeration and air conditioning. Topics include flaring and soldering techniques, compressor construction, domestic refrigeration, and characteristics of automatic controls.

ET111 Electrical Systems   Cr-4
This course provides the basic knowledge and skills necessary within any electrical service technician program. Topics include electrical units and metric prefixes; Ohm's Law; series and parallel DC resistive circuits; electrical energy and power relationships in DC circuits; AC sine wave generation; mutual inductance; inductive and capacitive reactance; instantaneous values of voltage and current; and real and apparent power. Troubleshooting techniques and strategies to identify, localize, and correct malfunctions are examined. Co-requisite: MA105 Technical Mathematics 1

ET112 Electronics of Remotely Piloted   Cr-3
Aircraft Systems
This course provides the student with basic knowledge of electrical theory. Topics include electron theory, Ohm's Law, series and parallel circuits, electrical energy and power relationships, electromagnetism, and DC & AC circuit theory as applied to remotely piloted aircraft vehicles.

ET115 Basic Electricity 1   Cr-3
This web-based course introduces basic electrical theory. The course is a study of electron theory, Ohm's Law, series and parallel circuits, electrical energy, power relationships, and electromagnetism. DC circuit theory is emphasized. This course does not satisfy the requirements for any courses in the Electrical Service Technician programs.

ET116 Basic Electricity 2   Cr-3
This web-based course is a continuation of ET115 Basic Electricity 1. It covers topics in AC electrical theory and investigates sine wave generation, mutual inductance, inductive and capacitive resistance, and instantaneous values of voltage and current as well as real and apparent power. This course does not satisfy the requirements for any courses in the Electrical Service Technician programs. Prereqisite: ET115 Basic Electricity 1.

ET123 Proper Refrigerant Usage   Cr-3
This course covers the impact of refrigerant on the global environment. Topics include ozone destruction, climate change, and EPA standards for the safe usage and handling of refrigerants. Additional topics include the Montreal Protocol and Clean Air Act of 1990.

ET127 Modern Industrial Practice   Cr-3
This course presents a broad introduction of topics related to industrial and manufacturing environments. Topics include safety and workplace hazard awareness, quality practices and measurement methods, modern manufacturing processes and production methods, and an awareness of maintenance procedures in manufacturing environments.

ET131 Electrical Machinery and Controls 1   Cr-4
This introductory course investigates the construction, operation, and control of electrical equipment installed and maintained by the various electrical trades. Topics pertain to direct current equipment and include shunt, series, and compound motors and generators, manual and automatic DC controllers, stepping motors, and DC meters. It emphasizes the practical aspects of magnetic flux, counter-electromotive force, armature and field currents, motor and generator loading conditions, and the relationship of these electrical characteristics to specific types of mechanical, electrical, and electronic controllers. Corequisite: ET102 Technical Electricity 2.

ET137 Sustainable Energy in the Developing   Cr-3
World
This course provides a study abroad experience for students interested in sustainable energy system use in the developing world. Travel sites vary depending on site availability and projects. Renewable energy

systems in the local region are studied in relation environmental, social, economic, and technological factors. Instructional lecture and practicum sessions, site visits, and service learning activities during the study abroad period by local experts and other faculty are included. Periodic classroom and online seminar sessions during the semester are required for student presentations and further project development activities. Additional Study Abroad fees apply. Prerequisites: Appropriate high school GPA or placement test score or MA089 Arithmetic.

ET141 Programmable Logic Controllers   Cr-3
This course is a study of the types, applications, and use of Programmable Logic Controllers (PLCs). It includes methods for developing PLC ladder programs, PLC installation, wiring, operation, maintenance, and troubleshooting. Experience is provided using Allen Bradley MicroLogix, SLC500, and Compactlogix PLCs, as well as the Logixpro PLC Simulator. Prerequisites: ET151 Circuits 1 and ET153 Introduction to Electronics or ET104 Systems Diagrams.

ET151 Circuits 1   Cr-4
This course introduces the fundamentals of DC circuit analysis including the definition of various electrical quantities and their relationships. Topics include series and parallel circuits, Kirchhoff's Laws, Thevenin's Theorem, Norton, super positioning, maximum power transfer, and nodal and mesh analysis. Proper usage of laboratory equipment is stressed. Corequisites: ET153 Introduction to Electronics and MA121 Fundamentals of College Mathematics 1 or MA122 Fundamentals of College Mathematics 2, or MA125 College Algebra & Trigonometry, or MA150 Pre-calculus, or MA151 Calculus 1.

ET152 Circuits 2   Cr-4
This course covers AC circuit analysis. Topics include Phasor representation of sinusoidal voltage, currents, impedance, power solution of RLC circuits, frequency response, and series and parallel resonance. Three phase power transformers and Fourier analysis of complex waveforms are introduced. The use of computer solutions in problem solving is included. Prerequisites: ET151 Circuits 1, or ET153 Introduction to Electronics, or ET154 Computer Programming. Corequisite: MA122 Fundamentals of College Mathematics 2, or MA150 Pre-calculus, or MA151 Calculus 1.

ET153 Introduction to Electronics   Cr-2
This course provides the basic theory of electrical and electronic devices with elementary applications, familiarization with laboratory test equipment, and construction of an electronic power supply project. It covers the practical aspects of resistors, capacitors, inductors, transformers and voltage regulators. Both AC and DC theory is discussed as well as the use of power supplies, function generators, digital multi-meters and the oscilloscope. The course concludes with the assembly and testing of a DC power supply. (Fall semester) Corequisites: ET151 Circuits or ET101 Technical Electricity 1.

ET154 Computer Programming   Cr-2
This course uses a high-level programming language and examines the available structure on a typical personal computer platform. Programming techniques and algorithm development are presented with real-world examples from the electrical field. The programming techniques may be used to solve practical problems in other EET courses. The course introduces the use of schematic capture and electrical circuit simulation software. This is a foundation course in computer programming for students in the Electrical Engineering Technology program. No previous programming knowledge is assumed. Corequisites: ET151 Circuits or ET101 Technical Electricity 1.

ET161 Linear Electronics   Cr-3
The theory and applications of modern transistors are introduced; both the bipolar junction transistor and the field effect transistor are examined. Applications include usage in small and large signal class A amplifiers, as well as in class B power amplifiers. Voltage control FET applications are studied. Problem solving techniques involving digital computers are discussed. Corequisites: ET152 Circuits 2.

ET163 Audio Technology   Cr-3
Modern audio technology is introduced. Topics include basic acoustics, transducers such as microphones and loudspeakers, signal processing, and amplification systems. An introduction to digital audio is included as well as software/Internet applications. Corequisites: ET152 Circuits 2 or ET102 Technical Electricity 2 or ET111 Electrical Systems.

ET167 Introduction to Photovoltaics   Cr-3
This course introduces fundamental concepts in photovoltaics in applications related to electrical power generation. Topics include types of photovoltaic systems and applications, solar radiation and resource determination, site assessment, and units of measurement common to solar systems. Measurement and instrumentation equipment as well as related tools, including safety and personal protective equipment (PPE), are discussed. Solar electrical systems including solar panels, inverters, charge controllers, batteries, and balance of system components are presented, with relevant aspects of electrical and mechanical discussed. Fundamental concepts of system sizing, cost, and economic analysis are presented. Prerequisite: ET101 Technical Electricity 1 or ET151 Circuits 1 or ET111 Electrical Systems.

ET181 Digital Electronics 1   Cr-3
This introductory course presents fundamental topics in digital systems. Topics include numbering systems and coding schemes used in digital logic; combinational logic devices at a functional level; concepts of Boolean algebra and logic analysis and methods for logic circuit simplification; and arithmetic circuits. Sequential circuits including latches and flip-flops are analyzed and their applications in basic coutners and registers are presented. Corequisite: ET152 Circuits 2.

ET209 Refrigeration 2   Cr-5
This course covers the components of refrigeration for commercial and industrial systems. It includes systems requirements and the application of components to develop built-up systems. Prerequisite: ET108 Refrigeration 1. (Fall semester)

ET220 Air Conditioning Principles   Cr-4
This course covers calculations of heat loss and gain based on residential and commercial levels. Topics include humidification; dehumidification; air mixture problems; and determination of U factors to enhance calculation accuracy. Additional topics include ventilation, exhaust loads and standards, and a working background in psychometrics. The course starts with simple heat properties of air and will progress to complex air mixture properties.

ET221 Air Conditioning Systems   Cr-5
This course introduces combustion techniques in oil and gas furnaces. It covers coil cells, stack controls, oil primary controls plus safety devices. Basic principles are applied to problem-solving in heat transfer. Types of systems involving residential and small commercial heating and air conditioning are covered. Split systems, hydronic systems, electric heat, heating and air conditioning controls, and package equipment are discussed along with heat pumps. Corequisites: ET108 Refrigeration 1.

ET222 Systems Design   Cr-3
This course covers refrigerant piping techniques and designs for commercial and industrial use. Refrigeration load calculating and equipment selection for commercial and industrial applications and proper air handling techniques are studied. Prerequisites: ET209 Refrigeration 2 and ET220 Air Conditioning Principles. (Spring semester)

ET223 Transport Refrigeration **Cr-4**

This course covers the refrigerant and electrical controls used in transport refrigeration. Topics include problems unique to the industry and fundamental approaches to gasoline and diesel engine principles. Prerequisite: ET209 Refrigeration 2.

ET224 Modern Hydronic Systems **Cr-3**

This course covers the design and installation of modern hydronic (water-based) heating and cooling systems in residential and small commercial buildings. Topics include hydronic heat sources, fluid flow-in pipes, circulators, terminal units, system sizing, distribution piping layout, controls, valve selection, expansion tanks, freeze proofing, and balancing. Co-requisite: ET220 Air Conditioning Principles

ET226 HVAC Diagnostics **Cr-3**

This course covers diagnostic techniques for HVAC/R systems. Topics include commercial refrigeration and supermarket equipment. Students utilize computers and simulations to analyze, test, and repair gas, oil, and heat pump systems. Prerequisite: ET209 Refrigeration 2.

ET230 AC Motors & Controls **Cr-5**

This course is intended for the heating, refrigeration, and air condition technicians. It provides HVAC students with theory and practicum in motors and controls, networking protocols, and automated building systems. The course has a blend of theory and practice suitable for vocational-technical students or industry practitioners who wish to upgrade their backgrounds. Electrical principles, components, meters, schematics, and systems are discussed and applied to modern small and large scale installations. Prerequisite: ET102 Technical Electricity 2.

ET232 Electrical Machinery and Controls 2 **Cr-4**

This course is designed to combine related information pertaining to AC machinery, electromechanical controllers, transducers, and electronic controls with the practical skills of equipment selection, installation, wiring, troubleshooting, and maintaining the machinery control systems currently used by industry. Topics include single and multiphase alternators, motors, transformers, and meters. Methods of machinery control include across-the-line starters, control relays, voltage and current transformers, limit switches, electronic switching, and speed or rotation sensors. Prerequisite: ET131 Electrical Machinery and Controls 1.

ET233 Industrial Electronics **Cr-4**

This course is a study of electromechanical and electronic devices in the operation of industrial equipment and manufacturing processes. Emphasis is places on the operating characteristics and applications of discrete components such as solid-state devices, thyristors, trigger devices, relays, timers, amplifies, and transducers. Laboratory experiments use skills and knowledge to diagnose and repair malfunctions in moderately complicated automated equipment. Prerequisite: ET104 System Diagrams.

ET234 Electrical Wiring and Codes 1 **Cr-3**

This course is an introduction to the art of electrical wiring. Installation of electrical equipment provides the student with the opportunity to combine related information and manipulative skills with the practical aspects of wiring methods for complete electrical installations and systems. All temporary laboratory wiring is installed in compliance with the current National Electrical Code and provides experience in cable, conduit, surface raceway, and service entrance installations. Corequisite: ET111 Electrical Systems.

ET235 Digital Logic **Cr-4**

This course provides an overview of the basic logic circuits inherent in all digital electronics applications. Topics include the various numbering systems, encoders and decoders used in digital systems, binary logic gates, flip-flops, counters, and shift registers with arithmetic circuits.

Memories and interfacing of digital and analog devices are also investigated. Experiments supporting related information are designed to provide maximum hands-on experience for students with no prior training in electronics. Corequisite: ET102 Technical Electricity 2.

ET236 Commercial - Industrial Wiring and **Cr-4**
Codes

This course provides an introduction to electrical wiring techniques with emphasis on design and layout of single and polyphase systems. Topics include diagnosis and repair of equipment malfunctions, interpretation of the National Electrical Code (NEC), estimation of project costs and progress, and installation techniques. Electrical systems studied include lighting, heating, ventilation, interior and exterior power distribution, and emergency energy conservation. Activities are focused on commercial and industrial electrical systems. Prerequisite: ET102 Technical Electricity 2.

ET241 Programmable Logic Controllers II **Cr-3**

This course is a continuation of Programmable Logic Controllers (PLC). The nature of the PLC programming framework, as specified by the IEC 61131-3, is explored as well as other PLC systems and Advanced Programming Interfaces (API). Student design and build PLC motor control circuits and discuss troubleshooting techniques for PLC based systems. Topics include Proportional Integral Derivative (PID) controls, analog based circuits, motor controls circuits with Variable Frequency Drives (VFD), and Human Machine Interface (HMI). Prerequisite: ET141 Programmable Logic Controllers

ET244 Electrical Wiring and Codes 2 **Cr-4**

This course includes continuation of electrical techniques with emphasis on design and layout of single and polyphase systems. Skills to be developed include diagnosis and repair of equipment malfunctions, interpretation of the National Electrical Code, and estimates of project costs and progress coupled with installation techniques. Electrical systems studied include lighting, heating, ventilation, interior and exterior power distribution, and emergency energy conservation. Activities are focused on electrical systems. Prerequisite: ET111 Electrical Systems and ET234 Electrical Wiring and Codes 1.

ET245 Microprocessor Technology **Cr-4**

This course applies knowledge of binary logic and circuits to elements, diagnostic procedures, and methods of operating and repairing microprocessor-based home and automated industrial equipment. Laboratory components include using personal computers and development systems to create microcontroller applications. An introduction to the architecture of the IBM 80x86 architecture is provided, and methods of assembly upgrading and maintaining PCs are presented. Prerequisites: ET235 Digital Logic.

ET246 Industrial Computer Applications **Cr-5**

This course introduces hardware and software applications of the personal computer. It covers applications involving interfacing, digital Input/Output, analog Input/Output, data acquisition, and computer control of external electrical devices. Hardware components are studied for an understanding of computer systems, and BASIC is used to write input/output instructions. Experiments include wiring, testing, and debugging of a digital/analog circuit board and trainer. Prerequisite: ET233 Industrial Electrontcs (Spring semester)

ET251 Mechatronics Systems **Cr-3**

This course provides hands-on experience in the control, maintenance, and simulation of a mechatronics system in a team environment to promote learning a broad array of job-ready troubleshooting skills in integrated technologies. Topics include system level programming/troubleshooting, application and calibration of hall-effect sensors, vacuum grippers, pneumatic robots, material feeding system, magnetic

sensors, photoelectric sensors, magnetic reed switches, limit switches, inductive sensor, capacitive sensors, ultrasonic sensor, synchronous belt drive, ball screw drives, part rejection/transfer, stepper motors, homing sensors, GMR (Giant Magnetoresistive) sensors, pneumatic screw feeders, pick and place assembly, gravity feeders, servo robotics, and parts transfer.

ET254 C Programming for Technology — Cr-3
This course details C programming language and how it is applied to problems in the technology field. A complete examination of the language is presented. Laboratory exercises are concerned with typical problems encountered in the electrical field. The focus is on desktop and embedded system development. Prerequisites: ET154 Computer Programming or equivalent. Corequisite: ET181 Digital Electronics 1.

ET262 Operational Amplifiers — Cr-4
This course includes further study of linear transistor circuits. Examination of frequency response and negative feedback are of prime importance. Operational amplifiers are discussed in great depth, including applications in summing, precision rectifying, voltage regulation, filtering, and other popular circuit applications. Usage of digital computers for anal ysis and design is discussed. Prerequisites: ET161 Linear Electronics.

ET265 Fiber Optics 1 — Cr-3
This introductory course in fiber optics covers the theory of light transmission and its limiting factors. It includes Modal and Chromatic Dispersion and signal attenuation along with how they impact on signal bandwidth. The various types of fiber optic cable are explored while noting their application characteristics. The course also covers the techniques for applying fiber optic connectors and splices as well as the use of light sources, light meters, fusion splicers and Optical Time Domain Reflectometers (OTDRs). Prerequisite: ET111 Electrical Systems.

ET274 Telecommunications Concepts — Cr-4
This course presents concepts related to the components, circuitry, and components of telecommunication systems. Topics include radio frequency amplifiers, filters, oscillators, measurement methods, modulation methods, coding and network models, transmission lines, antennas, and wave propagation. Prerequisite: ET161 Linear Electronics.

ET282 Digital Electronics 2 — Cr-3
This course covers the characteristics and applications of MSI circuits and devices such as decoders, encoders, multiplexers, and demultiplexers. The IC logic families are introduced at a circuit level. It emphasizes TTL devices along with ECL, I2L, MOS, and CMOS device characteristics. It includes semiconductor memory along with bipolar and MOS, static and dynamic, and ROM and RAM devices. Prerequisites: ET181 Digital Electronics 1 and ET161 Linear Electronics. (Fall semester)

ET283 Microprocessor Fundamentals — Cr-4
This course presents the microprocessor/microcontroller as the principal component of embedded systems, providing information on the architecture and programming model using the C language. C programming techniques for arithmetic and logic operations along with flow control are introduced. The use of functions, I/O instructions, and timers are presented with laboratory experiments. Corequisite: ET282 Digital Electronics 2.

ET284 Design & Layout — Cr-3
This capstone course provides for the application of electronic principles learned throughout the program. The course involves the steps necessary to take an electronic project from the design stage through to a final working project. Topics include typical company structure, specification and schedule development, proper prototyping and troubleshooting procedures, and the method for designing printed circuit boards. These topics are applied to an actual electronic project that results in a functioning circuit board - a working prototype. A final formal report is completed, submitted and presented to the class. Prerequisites: ET283 Microprocessor Fundamentals.

ET285 Motors and Controls — Cr-4
This course introduces the theory, operation, applications, adjustment, and control of AC/DC motors using single & three phase electrical power. It covers a variety of discrete devices, transformers, DC and AC motors, AC motor frequency drives, industrial networking, and motion control using PLCs. The components and characteristics of control systems are studied. Prerequisite: ET152 Circuits 2.

ET289 Introduction to Semiconductor Manufacturing — Cr-4
This course introduces the processes, materials, and equipment used in the manufacture of semiconductor devices. Topics include atomic theory, crystal structure, and properties of semiconductor materials, and manufacturing processes. It covers wafer preparation, thermal oxidation, doping, lithography, thin film deposition, metrology, testing, and packaging. Cleanroom safety and protocol are discussed. Prerequisites: ET161 Linear Electronics, and ET181 Digital Electronics 1. Corequisites: CH141 General Chemistry 1, and MT129 Statistical Quality Control. (Fall semester)

ET290 Fundamentals of High Vacuum Technology — Cr-3
This course introduces vacuum fundamentals, units, and terminology commonly found in low pressure environments. Topics include pumps, gauges, hardware components, vacuum systems, leak detection methods, thin film deposition, and etch processes, including sputtering and evaporative deposition. Additional topics include aspects of current practice in RF and plasma systems. Prerequisite: ET161 Linear Electronics. Corequisite: CH141 General Chemistry 1.

ET291 Fundamentals of Highly Automated Manufacturing Systems — Cr-3.5
This course introduces basic principles of systems encountered by technicians employed in highly automated manufacturing environments. Topics include manufacturing sequences, remote access, cycle time, and production flow analysis. Gant charts and other planning tools, troubleshooting, and routine/preventative maintenance procedures are presented. Manufacturing execution systems and applications of statistical process control are discussed. Prerequisites: MA106 Technical Mathematics 2 or MA121 Fundamentals of College Mathematics 1.