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NARTE and FCC approved test site



<http://www.arc.losrios.edu/~electron>

Degree: A.S. - Electronic Systems Technology
 A.S. - Mechtronics
 Certificates: Advanced Electronics and
 Telecommunications
 CMOS Mask Design
 Digital Repair & Upgrade Technician
 Electronic Systems Technology
 Fiber Optics
 Mechtronics
 Robotics
 Telecommunication Specialist

Certificates of Completion offered by the department:
 Basic Electronics and Telecommunications
 Biomedical Equipment Technology
 Digital Home Technology Integrator

Electronic equipment is present everywhere in our lives. From computerized traffic signals to personal computers and cellular telephones, modern electronic systems make our everyday lives easier, safer, and more efficient. Electronic technicians design, develop, build, install, repair and maintain many different types of sophisticated electronic devices.

The American River College Electronics program combines broad based Electronic and Telecommunications training with the newest specialty areas (such as Robotics, Fiber Optics, Programmable Interface Controllers and Stamp Microcontrollers). By working closely with our industry partners we ensure our curriculum is relevant and meets industry current and future needs. This relevant and up-to-date education prepares graduates for excellent career opportunities in the Electronics, Robotics or Telecommunications fields.

American River College is an official NARTE (National Association of Radio and Television Engineers) Federal Communication Commission (FCC) test site and offers an FCC license preparation course.

Electronic Systems Technology Degree and Certificate

The Electronics Systems Technology Degree or Certificate combines broad-based electronic and telecommunications training with specialty areas such as robotics, fiber optics, programmable interface controllers (PICs), and stamp microcontrollers.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Design and build several of the most common circuits used in electronic communication systems.
- Develop skills in building, testing, analyzing, and troubleshooting electronic communication systems.
- Apply theory and mathematics for evaluating the design, operation, and troubleshooting of integrated amplifier circuits such as comparators and operational amplifiers.
- Interpret data from a variety of test and measurement equipment used in analysis of electronic control systems.
- Identify and diagram schematic symbols used in electric and electrical industrial applications.

- Diagram and evaluate the components of Global Positioning Systems (GPS), satellite receivers and transmitters, AM and FM transmitters and receivers, and fiber optic communication links.
- Compare the differences between a mechanical splice and a fusion splice when working with fiber optic cable.
- Employ common hand tools in the mechanical installation of a sophisticated communication system.
- Analyze aviation, marine and commercial communication systems that are covered in the FCC General Class Radiotelephone license examination.
- Apply FCC rules and regulations governing commercial, aviation, and marine communication systems to practical communication systems.

Career Opportunities

This degree or certificate provides students with the knowledge to successfully enter a variety of electronics and telecommunication careers. Working closely with our industry partners and contacts ensures our curriculum is relevant and meets the current and future needs of the Electronics and Telecommunications Industry. American River College is an official test site of the National Association of Radio and Telecommunication Engineers (NARTE) for the Federal Communication Commission (FCC) General Radio Telephone License. Included in the electronics program is an FCC license preparation course. Obtaining the degree or certificate improves the opportunities for quality employment and career advancement.

Requirements for Degree or Certificate		34 Units
1st Semester:		
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 302	Principles of Electricity and Electronics	4
ET 307	High Tech Soldering and Fabrication Techniques	2
Other Semesters:		
ET 112	Communications Units.....	3
ET 143	Computer Upgrade, Repair, and Assembly	2
ET 310	Mathematics for DC Circuit Fundamentals, Part I	1.5
ET 311	Mathematics for AC Circuit Fundamentals, Part II.....	1.5
ET 322	Semiconductors and Nanotechnology	4
ET 335	Integrated Circuits with Computer Applications	4
ET 380	Introduction to Electronic Communications	4
ET 420	Microcontrollers and Digital Signal Processors	4

Associate Degree Requirements: The Electronic Systems Technology Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Mechtronics Degree and Certificate

This degree or certificate provides training in a multi-disciplinary field of which the primary focus is industrial automation. Topics such as electricity, electronics, industrial motor controls, programmable logic controllers, robotics, AC/DC drives, mechanical design, and manufacturing technologies are covered.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- integrate the principles of mechtronics to the design of mechatronic systems.
- evaluate mechanical and electrical solutions to solve technological problems.
- analyze data to create trouble shooting processes.
- apply mechatronic principles to the field of robotics and machine automation.

Career Opportunities

This degree or certificate prepares the student for the following career opportunities: Industrial mechanical/electrical systems technician, food processing machine service technician, facilities systems technician, waste water systems technician, manufacturing coordinator, field service technician, mechanical electrical machine systems installer. Obtaining the degree or the certificate improves the opportunities for quality employment and career advancement.

Requirements for Degree or Certificate 33-36 Units

1st Semester

ET 302	Principles of Electricity and Electronics	4
DESGN 100	Introduction to Computer Aided Drafting and Design (CADD)	3
WELD 300	Introduction to Welding	3

Other Semesters

DESGN 302	Technical Documentation with CADD	3
ET 143	Computer Upgrade, Repair, and Assembly	2
ET 192	Introduction to Robotics	2
ET 194	Intermediate Robotics	2
ET 195	Electrical and Mechanical Power and Control Systems ...	3
MGMT 360	Management Communication	3
PHYS 310	Conceptual Physics	3
[[ENGR 307	Industrial Materials Testing (3)	5 - 8
and MATH 100	Elementary Algebra (5)]	
or [DESGN 310	Graphic Analysis and Documentation (3).....	
and DESGN 330	Engineering Systems and Design (5)]]	
or [WELD 342	Symbol Reading, Layout and Fabrication (3)	
and ET 196	Sensors, Measurement, and Control (2)]	

Associate Degree Requirements: The Mechtronics Associate in Science (A.S.) Degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

Advanced Electronics and Telecommunications Certificate

This Advanced Electronics and Telecommunications certificate provides training in electronic system component identification and characteristics; computer component identification, repair, and upgrading; semiconductor theory and application; power supply design and operation; telecommunication copper and fiber optic systems; and advanced troubleshooting. This certificate is designed to be completed in two semesters.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Identify and describe the terminology used for working with personal computers.
- Demonstrate safe procedures for working with the internal components of a personal computer.
- Demonstrate and apply electro-static device (ESD) safety procedures for working with computer components.
- Demonstrate the removal and replacement of computer memory modules.
- Apply mathematics and semiconductor theory to identify, evaluate, and correct power supply and filter circuit problems.
- Analyze and apply mathematics, including logarithms and decibels to determine, analyze, and control outputs when problem solving transistor and field effect transistor (FET) circuits.
- Interpret data using various types of test and measurement equipment used in the analysis of power supply and amplifier circuits.
- Analyze and describe the components in a complete telecommunication system.
- Construct connectors and plugs used in telecommunication systems.
- Analyze test equipment data to determine the location of a communication system.
- Evaluate communication system components and select the best for a given application.
- Assess safety hazards when working with telecommunication systems.
- Research and interpret basic electronic components using manufacturers' data manuals, library resources, and the Internet.
- Calculate electronic component values to design.

Career Opportunities

The Advanced Electronics and Telecommunications certificate enables those students who have completed this certificate or are currently working in industry to quickly progress up the career ladder. More skills in the critical areas along with added electronics and telecommunications theory and laboratory practice make this an ideal certificate for those wishing to upgrade and update their electronics skills.

Requirements for Certificate 16 Units

1st Semester

ET 115	Fiber Optics and Telecommunications Cabling.....	4
ET 302	Principles of Electricity and Electronics	4
ET 307	High Tech Soldering and Fabrication Techniques	2

Other Semesters

ET 143	Computer Upgrade, Repair, and Assembly	2
ET 322	Semiconductors and Nanotechnology	4

CMOS Mask Design Certificate

The CMOS Mask Design Certificate presents advanced semiconductor theory. Topics include semiconductor physical design rules and integrated circuit concepts. State of the art design software provides hands on experience.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- implement CMOS technology in the construction and layout of integrated circuits.
- interpret logic diagrams and convert to transistor-level integrated circuit (IC) components.
- apply design rules the layout of specialized circuits using standard cell design rules.
- draw basic semiconductor cells using integrated circuit layout software tools.
- modify specialized circuits using previously designed standard IC cells.
- differentiate schematic symbols.
- explain theory of operation of the seven basic logic gates.
- create schematic diagrams and trace logic signals through a circuit.

Career Opportunities

By earning a CMOS Mask Design Certificate students are qualified for a wide variety of employment opportunities at an entry level position in the semiconductor industry. Experience using state of the art design software allows students hands-on experience using the same programs used by industry. Incorporating semiconductor theory along with semiconductor physical design rules and concepts make this an ideal certificate for those desiring employment in the semiconductor manufacturing industry.

Requirements for Certificate	10 Units
ET 205 CMOS Mask Design I	3
ET 206 CMOS Mask Design II	3
ET 335 Integrated Circuits with Computer Applications	4

Digital Repair and Upgrade Technician Certificate

The Digital Repair and Upgrade Technician certificate combines basic electronics theory and application with computer repair and support skills. Topics including high-tech soldering along with component and system level electronics are focused on in the electrical area. Computer repair skills and support are covered in the computer area.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Apply the rules of electrical safety for working with personal computers and associated equipment.
- Identify and describe the terminology used for working with personal computers.
- Identify and properly name the components inside a personal computer.
- Upgrade and install new and updated software programs.
- Find and download updated system drivers from the Internet.
- Compare and evaluate solder connections in accordance with industry standards.
- Evaluate operational characteristics of electronic components and devices operating under normal and abnormal conditions.

- Recognize, measure, and evaluate resistance, capacitance and inductive devices.
- Analyze and troubleshoot basic electronic circuits.
- Research and interpret basic electronic components using manufacturers' data manuals, library resources, and the Internet.

Career Opportunities

The Digital Repair and Upgrade Technician certificate prepares the student for a wide variety of jobs in the computer industry, such as, network communication cable installer, interface troubleshooter, and fiber optic installer.

Requirements for Certificate	12-15 Units
CISC 320 Operating Systems	1
CISC 361 Microcomputer Support Essentials - Preparation for A+ Certification	3
CISC 363 Microcomputer Support Technical - Preparation for A+ Certification	3
ET 143 Computer Upgrade, Repair, and Assembly	2
ET 298 Work Experience in Electronics Technology	1 - 4
ET 307 High Tech Soldering and Fabrication Techniques	2

Fiber Optics Certificate

The Fiber Optics certificate is an introduction into fiber optics technology. Topics include fusion and mechanical splicing, fiber connectivity, optical time domain reflectometer (OTDR), and other specialized test equipment operations. System design, installation, troubleshooting, and repair are emphasized. Courses in communication theory and copper cabling are included in the certificate, producing a technician with a wide variety of skills.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Define the terminology used with single mode fiber optic cable.
- Apply correct safety procedures when working with high power fiber optic modules and test equipment.
- Calculate the attenuation in a complete fiber optic communication system.
- Inspect and identify fiber optic system problems.
- Evaluate communication system components for a given application.
- Compare fiber optic component specifications using manufacturers' data manuals, reference books, and the Internet.
- Perform inspection and quality control of fusion and mechanical fiber optic splices.

Career Opportunities

The Fiber Optic certificate prepares the student to obtain entry level employment in a wide variety of positions in the telecommunication and fiber optic industry. It is also valuable for people working in the industry to upgrade their skill level to include the newest advancements in fiber technology.

Requirements for Certificate	17 Units
ET 115 Fiber Optics and Telecommunication Cabling	4
ET 302 Principles of Electricity and Electronics.....	4
ET 380 Introduction to Electronic Communications	4
ET 386 Fiber Optic Splicing, Connectivity and Testing	3
ET 387 Advanced Fiber Optics	2

Robotics Certificate

The Robotics certificate provides an overview of electronics and robotic theory and application, programming, design, and modification. Electronics theory and application are stressed along with sensors and controllers, an important part of the next generation of robotics. Various robotic platforms are used to give a wide understanding of all types of current and future systems.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Identify and describe the terminology used when working with Parallax stamp micro-controllers.
- Program and troubleshoot the Parallax stamp micro-controller using P-Basic language.
- Evaluate operational characteristics of electronics components and devices operating under normal and abnormal conditions.
- Synthesize and analyze electronic circuitry using computer electronic simulation software.
- Compare and evaluate solder connections in accordance with industry standards.
- Calculate speed and acceleration of robotic motion.
- Compare DC motor and servo motor characteristics.
- Analyze a fluid power schematic diagram and design a simple hydraulic circuit.

Requirements for Certificate		15 Units
ET 192	Introduction to Robotics	2
ET 194	Intermediate Robotics	2
ET 195	Electrical and Mechanical Power and Control Systems ...	3
ET 196	Sensors, Measurement, and Control	2
ET 302	Principles of Electricity and Electronics	4
ET 307	High Tech Soldering and Fabrication Techniques	2

Telecommunication Specialist Certificate

The Telecommunication Specialist certificate provides both theory and hands-on application using fiber optics, coaxial cable, and CAT 6 data cable. All aspects of communication systems are covered including antennas, transmitters and receivers, transmission lines, and signal propagation. System design and troubleshooting are also included.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Evaluate potential problems associated with electrostatic discharge (ESD).
- Analyze and troubleshoot basic electronic circuits.
- Compare and contrast series and parallel resistive, capacitive, and inductive devices.
- Analyze the differences between surface mount techniques and through-hole techniques.
- Analyze and describe the components of a complete telecommunication system.
- Design an office building telecommunication system using fiber optics and copper cable.
- Examine and evaluate the decibel losses and gains in a complete fiber optic communication system.
- Assess safety hazards when working with fiber optic systems and associated test equipment.
- Perform repairs and adjustments to electronic communication systems according to factory specifications.
- Install epoxy, hotmelt, anaerobic, and mechanical connectors on multimode fiber optic cable.

- Prepare cost estimates for fiber optic and copper network installation using computer software.
- Identify and diagram schematic symbols used in industrial electronic and electrical applications.
- Analyze aviation, marine and commercial communication systems that are covered in the FCC General Class Radiotelephone license examination.
- Apply FCC rules and regulations governing commercial, aviation, and marine communication systems to practical communication systems.

Career Opportunities

The Telecommunication Specialist certificate provides training for design, installation, and maintenance of any type of wired or wireless communication systems, such as, remote monitoring, radio frequency (RF) control, radio and television transmitters, public safety and government communication equipment, and fiber optic systems.

Requirements for Certificate		22 Units
1st Semester		
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 302	Principles of Electricity and Electronics	4
ET 307	High Tech Soldering and Fabrication Techniques	2
Other Semesters		
ET 112	Communications Units.....	3
ET 380	Introduction to Electronic Communications	4
ET 386	Fiber Optic Splicing, Connectivity and Testing	3
ET 387	Advanced Fiber Optics	2

Basic Electronics and Telecommunications Certificate

The Basic Electronics and Telecommunication certificate provides training in basic electronics theory and applications, telecommunication copper and fiber optic systems, and surface mount soldering devices (SMD). It also includes schematic symbol interpretation, and basic electronic troubleshooting. The courses required for this certificate can be completed in one semester, making it an ideal stepping stone to the Advanced Electronics and Telecommunications certificate.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- Evaluate potential problems associated with electrostatic discharge (ESD).
- Compare and evaluate solder connections in accordance with industry standards.
- Analyze the differences between surface mount techniques and through-hole techniques.
- Inspect SMDs using a high-magnification observation station.
- Identify and diagram schematic symbols used in electronic and electrical industrial applications.
- Analyze and troubleshoot basic electronic circuits.
- Compare and contrast series and parallel resistive, capacitive, and inductive devices.
- Analyze and describe the components in a complete telecommunication system.
- Construct connectors and plugs used in telecommunication systems.
- Analyze test equipment data to determine the location of a communication system.
- Evaluate communication system components and select the best for a given application.
- Assess safety hazards when working with telecommunication systems.

Career Opportunities

The Basic Electronics and Telecommunications certificate is designed for anyone wanting to enter the electronics or telecommunications industry. This certificate satisfies the requirements of a variety of entry-level positions, such as, printed circuit board (PCB) assembler, telecommunication field technician, or rework technician.

Requirements for Certificate		10 Units
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 302	Principles of Electricity and Electronics	4
ET 307	High Tech Soldering and Fabrication Techniques	2

Biomedical Equipment Technology Certificate

This certificate covers the operation, maintenance, troubleshooting, and certification of biomedical equipment used in the medical device industry. It includes an in-depth study of frequently used medical equipment. It prepares electronics technology students for a biomedical technician internship or trainee position.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate the data from basic preventive maintenance tests on the following equipment: multi-parameter physiological monitor, electrocardiogram (ECG) machine, blood pressure monitor, defibrillator, pulse oximeter, infusion pump, and electro-surgical unit.
- distinguish and list various medical imaging technologies.
- set up standard electrical measurement tools and differentiate the uses for calibration and troubleshooting of medical equipment.
- set up the following equipment: multi-parameter physiological monitor, ECG machine, blood pressure monitor, defibrillator, pulse oximeter, infusion pump, and electro-surgical unit.
- categorize biopotentials and electrodes as they relate to basic human anatomy and physiology systems.
- associate the applicable regulation with the regulating organizations.
- list and compare the different types of bioelectric amplifiers, signal processing circuits, and isolation circuits.
- compare and contrast the protocols for working in the operating room and special care units in the hospital.

Career Opportunities

This program covers the theory and training on biomedical equipment for electronics technicians interested in working in the medical device service industry for hospitals, medical device manufacturers, or other service organizations.

Requirements for Certificate		17 Units
ET 302	Principles of Electricity and Electronics.....	4
ET 322	Semiconductors and Nanotechnology (4).....	4
or ET 335	Integrated Circuits with Computer Applications (4)	
or ET 380	Introduction to Electronic Communications (4)	
ET 425	Introduction to Biomedical Equipment Technology	4
ET 426	Advanced Biomedical Equipment Technology	4
A minimum of 1 unit from the following:.....		1
ET 260	Introduction to Medical Ultrasound Equipment (0.5)	
ET 261	Introduction to Biomedical Equipment Networking (0.5)	
ET 262	Introduction to Respiratory Therapy Ventilators (0.5)	
ET 263	Introduction to Medical X-ray Imaging Equipment (1)	

Digital Home Technology Integrator Certificate

This certificate provides training to configure, integrate, maintain, and troubleshoot electronic and digital home integration systems. Coursework provides the essential skills for residential networking concepts, components, and information on home network installation. This includes techniques to install, trim, terminate, and troubleshoot cabling systems. In addition, it provides the training and skills necessary to integrate audio, security and environmental controls in a complete system.

Student Learning Outcomes

Upon completion of this program, the student will be able to:

- design a home data network
- construct a home telephone network
- evaluate and troubleshoot a home network
- assemble a home audio and video network
- build a wireless home network
- certify a homes data and telephone network
- set up a security and fire alarm system in a home
- apply industry standards to system design for a home

Career Opportunities

The Digital Home Technology Integrator certificate prepares individuals to design, install, and support residential networks and home integration for employment in the home technology industry. This program develops the technicians's ability to configure, integrate, maintain and troubleshoot home theater, music, security, and home networks.

Requirements for Certificate		17 Units
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 143	Computer Upgrade, Repair, and Assembly.....	2
ET 302	Principles of Electricity and Electronics.....	4
ET 385	Digital Home Technology Integration	4
ET 386	Fiber Optic Splicing, Connectivity and Testing	3

ET 101 Introduction to Amateur Radio .5 Units

Hours: 9 hours LEC

This course introduces the fundamentals of amateur radio for public and emergency communication. It covers the equipment, procedures, and uses for amateur (Ham) radio.

ET 103 Ham Radio Technician License Preparation 2 Units

Hours: 36 hours LEC

This course covers the fundamentals of amateur radio required to pass the national Association for Amateur Radio Relay League (ARRL) amateur radio operators technician license. Topics include wave theory, operator rules, proper radio operation, electronics review, and regulations.

ET 110 Communications Systems 5 Units

Prerequisite: ET 330 or 335; and ET 380 with a grade of "C" or better. Hours: 54 hours LEC; 108 hours LAB

This course is a comprehensive study of high frequency communication concepts including antennas, transmission lines, transmitters and receivers. Commercial telecommunication equipment and schematics are used to simulate equipment that is utilized in industry. System design, component and equipment analysis and troubleshooting are stressed. Extensive use of laboratory experiments enhances theory. A field trip is required.

ET 112 Communications Units 3 Units*Advisory: ET 380**Hours: 54 hours LEC*

This course provides an overview of the Federal Communication Commission (FCC) General Radiotelephone license requirements. It also covers both the electronics theory required and the rules and regulations mandated by the FCC. Field trips may be required.

ET 113 Introduction to Residential Telecommunication Wiring .5 Units*Hours: 9 hours LEC*

This course covers the proper procedures to design, install, and test telecommunication wiring for the home. Safety is stressed throughout the course. Hands-on experience installing Cat3 and Cat5 telephone and data cables is covered. Proper termination and installation is also discussed. This course may be taken four times covering different technologies found in the home telecommunications network.

ET 115 Fiber Optics and Telecommunication Cabling 4 Units*Advisory: ET 307.**Hours: 54 hours LEC; 54 hours LAB*

This course is an introduction to the concepts of telecommunication cable installation and connection practices and standards. It includes the study of commonly used fiber and copper cable types and connectors, installation tools, and test equipment. Emphasis is on installation techniques in practical situations. Laboratory activities provide practical experience in the operation and use of tools and test equipment specific to the telecommunication industry. Field trips are required.

ET 143 Computer Upgrade, Repair, and Assembly 2 Units*Hours: 18 hours LEC; 54 hours LAB*

This course covers basic personal computer upgrading, repair, and assembly. Safety, terminology, component identification, file management, upgrades, and virus protection are among the topics that are covered. This class may be taken twice for credit.

ET 154 Wireless Communication Systems 1.5 Units*Hours: 18 hours LEC; 27 hours LAB*

This is an introduction to wireless communication designed for electronic technicians. The course includes wireless communication terminology and instruction in the proper use of hardware and test equipment used in installation, maintenance and operation. Topics include the study of individual system component theory and operation as well as the entire wireless communication system.

ET 190 Introduction to Programmable Logic Controllers (PLCs) 2 Units*Hours: 36 hours LEC*

This course introduces the fundamentals of the operation and use of the Programmable Logic Controllers (PLC). The PLC uses programmable memory to store instructions and executes specific functions that include on/off control, timing, counting, and sequencing arithmetic used in machine control. Ladder logic is used in programming and troubleshooting the PLC. Field trips may be required.

ET 192 Introduction to Robotics 2 Units*Hours: 36 hours LEC*

This course is an introduction to robotics utilizing the Parallax stamp microcontroller and Boe-Bot robotic vehicle. It explores how robots and microcontrollers interface with common electronic applications. It also investigates unusual and innovative applications for robots and microcontrollers. Field trips are required.

ET 194 Intermediate Robotics 2 Units*Hours: 36 hours LEC*

This course covers advanced robotics utilizing the Parallax stamp microcontroller and Boe-Bot robotic vehicle. Topics include the operation and design of robots using the Robix robotic platform. This course includes how robotics and automation are utilized in industry. Hardware component selection, assembly, and software programming of various types of robotic assemblies are emphasized. The principles of electronics, physics, and engineering as they apply to robotic design are presented. Field trips are required.

ET 195 Electrical and Mechanical Power and Control Systems 3 Units*Hours: 54 hours LEC*

This course is a study of electrical and mechanical power components and systems used in the control and transmission of mechanical and electrical power. Topics include the analysis of electric circuits and controls; programmable logic controllers (PLC's), electromagnetic devices and their use in systems; discrete semiconductor switching devices; hydraulic and pneumatic power devices; types and uses of electric motors and generators as well as power distribution systems. Troubleshooting and repair of hydraulic, pneumatic control equipment and electrical / electronic systems are studied through a number of industry-based projects.

ET 196 Sensors, Measurement, and Control 2 Units*Hours: 36 hours LEC*

This course is a detailed study of the physical world and the sensors which measure its properties. Signals from these sensors are converted for display and used to control physical properties such as temperature or pressure. Lecture and demonstrations reinforce theory and provide experience in sensor identification and troubleshooting. Microcontrollers are used to simulate industrial situations.

ET 205 CMOS Mask Design I 3 Units*Prerequisite: ET 302 with a grade of "C" or better**Hours: 48 hours LEC; 18 hours LAB*

This course introduces the foundations of the design and functionality of complementary, metal-oxide, semiconductor (CMOS) integrated-circuit (IC) computer chips. It reviews the history and evolution of computer chips, how they are manufactured, function, and applied. Additional topics include a detailed study on reading, interpreting, and creating logic diagrams, transistor level schematics, cross sectional views, and layouts associated with CMOS IC's as well as the application of design rules, area estimation, pin and bus placements, and efficient circuit layouts. This course prepares students for entry-level mask design and technician positions in the computer industry.

ET 206 CMOS Mask Design II 3 Units*Prerequisite: ET 205 with a grade of "C" or better**Hours: 36 hours LEC; 54 hours LAB*

This course builds on CMOS Mask Design I (ET 205). It applies complex logic and design rules for integrated circuit (IC) layout. It also includes practical experience in the use of an industry-standard integrated circuit design tool, and IC and mask design principles and applications.

ET 235 PACE: Beginning Robotics 1 Unit*Hours: 18 hours LEC*

This electronics course is designed for students enrolled in the Partnership to Assure College Entry (PACE) program. It is an introduction to robotics. Topics include electronic and mechanical components, test equipment, basic circuit functions, and job opportunities.

ET 303 Energy and Sustainability 3 Units*Same As: ENERGY 303 and NATR 303**General Education: AA/AS Area IV**Course Transferable to CSU**Hours: 54 hours LEC*

Fundamentals of energy and its impact on society and the environment are covered in this course. The mechanics, advantages and disadvantages of current and future renewable, green and nonrenewable energy sources are investigated. Residential energy audits are covered. Field trips are required. This course is not open to students who have completed ENERGY 303 or NATR 303.

ET 307 High Tech Soldering and Fabrication Techniques 2 Units*Advisory: ET 302.**Course Transferable to CSU**Hours: 18 hours LEC; 54 hours LAB*

This course teaches fundamental soldering techniques required in the Electronics industry. Lecture and lab exercises introduce state of the art processes involving safety, component and tool identification, diagrams, terms, standards, soldering [plated through hole (PTH), surface mount (SMT), fine and ultra fine pitch], de-soldering, electrostatic discharge (ESD), devices and assembly. Field trips are required. This course may be taken twice for credit.

ET 308 Advanced Soldering Techniques 2 Units*Prerequisite: ET 307 with a grade of "C" or better**Course Transferable to CSU**Hours: 18 hours LEC; 54 hours LAB*

This course provides training in the standards, processes, and techniques related to the field of lead-free soldering. Emphasis is placed on the differences between lead and lead-free soldering processes. The safe handling, use, and operation of equipment, materials, components, and assemblies are covered. Additional topics include Electrostatic Discharge (ESD), Printed Circuit Board (PCB) component assembly, lead-free soldering and desoldering procedures and techniques in Plated Through Hole (PTH), Surface Mount Technology (SMT), and fine to ultra fine pitch soldering. A lead-free soldering certificate is issued upon completion. Field trips may be required.

ET 310 Mathematics for DC Circuit Fundamentals, Part I 1.5 Units*General Education: AA/AS Area II(b)**Course Transferable to CSU**Hours: 27 hours LEC*

This course covers mathematics for direct current (DC) circuit fundamentals. Powers of ten, algebra and other mathematical concepts necessary for calculation of resistance, DC voltage and current distribution in series, parallel, and combination circuits are covered.

ET 311 Mathematics for AC Circuit Fundamentals, Part II 1.5 Units*Prerequisite: ET 310 with a grade of "C" or better**General Education: AA/AS Area II(b)**Course Transferable to CSU**Hours: 27 hours LEC*

The foundations of mathematics used in the analysis of alternating current (AC) circuits are covered in this course. Topics include algebra and trigonometry for the mathematical analysis of AC circuits involving resistance, capacitance, inductance and/or reactances in series, parallel and combination circuits.

ET 322 Semiconductors and Nanotechnology 4 Units*Prerequisite: ET 302 with a grade of "C" or better**Advisory: ET 310 and 311**Course Transferable to CSU**Hours: 54 hours LEC; 54 hours LAB*

This course is a detailed study of semiconductor devices and their applications. Semiconductor components - such as diodes, transistors, op-amps, including their use in complex circuits - are covered. Nanotechnology theory and devices, including their present and possible future applications, are studied. Field trips may be required.

ET 335 Integrated Circuits with Computer Applications 4 Units*Prerequisite: ET 302 with a grade of "C" or better**Course Transferable to CSU**Hours: 54 hours LEC; 54 hours LAB*

This course covers integrated circuits (IC's) and applications used in industrial and consumer products. Topics include digital theory and applications from standard transistor-transistor logic (TTL) logic circuits to complex circuits built on programmable logic devices (PLDs). Field trips may be required.

ET 361 Printed Circuit Board Design 1 Unit*Prerequisite: ET 302 with a grade of "C" or better; or placement through the assessment process.**Course Transferable to CSU**Hours: 9 hours LEC; 27 hours LAB*

This course is an introduction to the concepts of printed circuit board (PCB) design and manufacturing. Topics include the development of electronic circuit schematics, component selection and layout, and the interconnection of devices. PCB design software is used to create schematics, board layouts, silkscreens, and manufacturing code. A field trip may be required.

ET 369 The Design and Fabrication of Electronics Projects 2 Units*Prerequisite: ET 322 with a grade of "C" or better.**Course Transferable to CSU**Hours: 18 hours LEC; 54 hours LAB*

This course provides an opportunity for students to design and build advanced projects. It enables students to work on approved electronics projects outside the scope of typical classroom applications. Students learn the process of planning, design, prototyping, and fabrication while building an actual working project. Completed projects are entered in county and statewide technology such as the California State Fair Industrial Technology competition. A completed project is a course requirement. Projects can be completed individually or in teams. Field trips are required. This course may be taken three times on different projects.

ET 380 Introduction to Electronic Communications 4 Units*Prerequisite: ET 301 or ET 302 with a grade of "C" or better.**Course Transferable to CSU**Hours: 54 hours LEC; 54 hours LAB*

This course covers UHF, VHF, microwave, satellite, and fiber optics. AM and FM transmitters, transmission lines, antennas, and receivers are analyzed down to the component level. Propagation, wave theory, decibels, and signal transmission limitations are also covered. Technician safety and proper test equipment use are stressed throughout the course. Field trips are required.

ET 385 Digital Home Technology Integration 4 Units

Prerequisite: ET 115 with a grade of "C" or better

Course Transferable to CSU

Hours: 54 hours LEC; 54 hours LAB

This course covers the fundamentals of Home Technology Integration (HTI). It includes the study of and practical experience in installation, integration, and troubleshooting of entertainment, voice, security, data, and networking systems found in the home or small office. Field trips are required. This course may be taken two times on different certification requirements.

ET 386 Fiber Optic Splicing, Connectivity and Testing 3 Units

Course Transferable to CSU

Hours: 54 hours LEC

This is an introductory course in fiber optic theory and operation including the complete fiber optic communication system. It includes fiber optic terminology and instruction in the proper use of tools and equipment associated with fiber optic installation and maintenance. Tests of the fiber optic systems are performed using sophisticated equipment such as optical power meters and Optical Time Domain Reflectometer (OTDR). A field trip is required. This course may be taken twice for credit using different equipment.

ET 387 Advanced Fiber Optics 2 Units

Prerequisite: ET 386 with a grade of "C" or better.

Course Transferable to CSU

Hours: 36 hours LEC

This course covers advanced fiber optic theory and operation. Fiber optic systems are vital communication links that enable high speed transfer of video, telephone, and data to occur. Testing of fiber optic systems using sophisticated electro-optical test equipment such as the Optical Time Domain Reflectometer (OTDR) is included. This course also introduces the use of computer based software to simplify fiber optic system design. May be taken twice for credit.

ET 420 Microcontrollers and Digital Signal Processors 4 Units

Prerequisite: ET 302 with a grade of "C" or better

Course Transferable to CSU

Hours: 54 hours LEC; 54 hours LAB

This course is an in-depth study of microcontrollers and digital signal processors (DSP). The focus is on digital concepts, such as data flow, internal architecture, memory, data converters, special registers, and the interfacing of input/output devices, sensors, and motors. Field trips may be required.

ET 425 Introduction to Biomedical Equipment Technology 4 Units

Prerequisite: ET 302 with a grade of "C" or better

Course Transferable to CSU

Hours: 72 hours LEC

This course covers the foundation of biomedical equipment and the responsibilities of electronics technicians in the medical device service industry for hospitals, medical device manufacturers, or other service organizations. It includes a detailed study of the operation and maintenance of hospital equipment, systems and procedures, and the related electronic systems. Additional topics include basic anatomy and physiology as they relate to the biomedical equipment. Field trips are required.

ET 426 Advanced Biomedical Equipment Technology 4 Units

Prerequisite: ET 425 with a grade of "C" or better

Course Transferable to CSU

Hours: 54 hours LEC; 54 hours LAB

This course covers the operation, maintenance, troubleshooting, and certification of biomedical equipment used in the medical device industry. It includes an in-depth, hands-on study of frequently used medical equipment preparing electronic technology students for a biomedical technician internship or trainee position in a hospital, medical device manufacturer, or other service organization. Field trips are required.

ET 490 Advanced Student Projects Laboratory 2 Units

Prerequisite: ET 322, 335, or 380 with a grade of "C" or better

Course Transferable to CSU

Hours: 108 hours LAB

This course provides opportunities to pursue advanced projects selected by the Electronics department. It may be taken two times for credit on different projects.