Electronics Technology

Overview

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.

Division Dean
Gary Aguilar
Department Chairs
Gary George
Phone (916) 484-8354

Associate Degrees

A.S. in Electronic Systems Technology

This degree combines broad-based electronic and telecommunications training with specialty areas such as robotics, fiber optics, programmable interface controllers (PICs), and stamp micro-controllers.

Catalog Date: June 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Semester - Basic Certificate:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET 115</td>
<td>Fiber Optics and Telecommunication Cabling</td>
<td>4</td>
</tr>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>ET 308</td>
<td>Technical Soldering Practices and Techniques</td>
<td>2</td>
</tr>
<tr>
<td>Second Semester - Advanced Certificate:</td>
<td></td>
<td></td>
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<tr>
<td>ET 312</td>
<td>Mathematics for Circuit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ET 322</td>
<td>Semiconductors and Nanotechnology</td>
<td>4</td>
</tr>
<tr>
<td>Following Semesters:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ET 381</td>
<td>Electronic Communication Regulations</td>
<td>3</td>
</tr>
<tr>
<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
<td>4</td>
</tr>
<tr>
<td>ET 335</td>
<td>Integrated Circuits with Computer Applications</td>
<td>4</td>
</tr>
<tr>
<td>ET 380</td>
<td>Introduction to Electronic Communications</td>
<td>4</td>
</tr>
<tr>
<td>ET 420</td>
<td>Microcontrollers and Digital Signal Processors</td>
<td>4</td>
</tr>
<tr>
<td>Total Units:</td>
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<td>36</td>
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</tbody>
</table>

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.

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 electronics technology.
- calculate the mathematical relationships among voltage, current, resistance, capacitance, inductance, reactance, frequency, and phase angle as they relate to electronic circuits.
- analyze aviation, marine, and commercial communication systems that are covered in the FCC General Class Radiotelephone license examination.
- analyze operating and defective electronic circuits by interpreting data from a variety of test and measurement equipment.
- differentiate and diagram schematic symbols used in electronic and electrical industrial applications.
- use common hand tools in the mechanical installation of copper and fiber optic cabling used in sophisticated communication systems.
- research and interpret basic electronic components using manufacturers' data manuals, library resources, and the Internet.
- evaluate electrical parameters using various types of test and measurement equipment used in the analysis of power supply, amplifier, and general electronic circuits.

Career Information

This degree 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. Obtaining the Associate of Science degree and the certificate improves the opportunities for quality employment and career advancement.

A.S. in Mechatronics

This degree provides training in a multi-disciplinary field focusing on industrial automation. Topics include electricity, electronics, industrial motor controls, programmable logic controllers, robotics, AC/DC drives, mechanical design, and manufacturing technologies.

Catalog Date: June 1, 2020

Degree Requirements
COURSE CODE | COURSE TITLE | UNITS
---|---|---
DESIGN 301 | Introduction to Computer Aided Drafting and Design (CADD) | 3
ET 302 | Principles of Electricity and Electronics | 4
WELD 300 | Introduction to Welding | 3

Other Semesters:
DESIGN 302 | Technical Documentation with CADD (3) | 3
or ENGR 312 | Engineering Graphics (3) | 3
ET 193 | Introduction to Robotics and Sensors | 4
ET 197 | Introduction to Mechatronics | 4
ET 253 | Industrial Communication Systems Support | 4

Total Units: 25

The Mechatronics 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.

Student Learning Outcomes

Upon completion of this program, the student will be able to:
- integrate the principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply industry-appropriate design techniques to develop technical design documents from a conceptual design.
- design robotic and machine automation systems using mechatronic principles.
- evaluate welding projects in accordance with welding procedures and specifications.
- contrast DC, AC, brushless, serve, and stepper motor operation.
- create technical documentation/presentations of models from the mechanical engineering discipline in both technically correct and visually pleasing solid, orthographic, and section view formats.
- design programmable logic controller (PLC) programs demonstrating input/output capabilities.
- design programs for an operator interface terminal (OIT) demonstrating input/output capabilities.

Career Information

This degree prepares students for the following technical and supervisory career opportunities: industrial mechanical/electrical systems technician, food processing machine service technician, facilities systems technician, waste water systems technician, manufacturing coordinator, field service technician, and mechanical electrical machine systems installer.

Certificates of Achievement

Advanced Electronics and Telecommunications Certificate

This certificate provides training in electronic system component identification and characteristics, semiconductor theory and application, power supply design and operation, telecommunication copper and fiber optic systems, the mathematics for circuit analysis, and advanced troubleshooting. It is designed to be completed in two semesters.

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>UNITS</th>
</tr>
</thead>
</table>
ET 115 | Fiber Optics and Telecommunication Cabling | 4 |
ET 302 | Principles of Electricity and Electronics | 4 |
ET 308 | Technical Soldering Practices and Techniques | 2 |
ET 312 | Mathematics for Circuit Analysis | 3 |
ET 322 | Semiconductors and Nanotechnology (4) | 4 |
or ET 380 | Introduction to Electronic Communications (4) | 4 |
or ET 335 | Integrated Circuits with Computer Applications (4) | 4 |

Total Units: 17

Student Learning Outcomes

Upon completion of this program, the student will be able to:
- analyze circuit operating characteristics by applying Ohm’s, Watt’s, and Kirchhoff’s laws.
- research and interpret basic electronic components using manufacturers’ data manuals, library resources, and the Internet.
- analyze and apply mathematics, including logarithms and decibels to determine, analyze, and control outputs when problem solving transistor and field effect transistor (FET) circuits.
- evaluate electrical parameters using various types of test and measurement equipment used in the analysis of power supply and amplifier circuits.
- apply mathematics and semiconductor theory to identify, evaluate, and troubleshoot electronic circuits.
- calculate the mathematical relationships among voltage, current, resistance, capacitance, inductance, reactance, frequency, and phase angle as they relate to electronic circuits.
- construct and test circuits on prototyping boards and printed circuit boards.
- design and simulate circuits in software.

Career Information

This certificate program enables students to find employment in the electronics industry or to progress up the career ladder. Skills development in the critical areas along with electronics and telecommunications theory and laboratory practice make this an ideal certificate for those wishing to upgrade and update their electronics skills.

Biomedical Equipment Technology Certificate

This certificate covers the theory, operation, maintenance, troubleshooting, and certification of biomedical equipment used in hospitals, medical device manufacturers, or other service organizations. It includes an in-depth study of frequently used medical equipment.
Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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</thead>
<tbody>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
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<tr>
<td>ET 312</td>
<td>Mathematics for Circuit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ET 322</td>
<td>Semiconductors and Nanotechnology (4)</td>
<td>4</td>
</tr>
<tr>
<td>or ET 335</td>
<td>Integrated Circuits with Computer Applications (4)</td>
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<tr>
<td>or ET 380</td>
<td>Introduction to Electronic Communications (4)</td>
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<tr>
<td>ET 425</td>
<td>Introduction to Biomedical Equipment Technology</td>
<td>4</td>
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<tr>
<td>ET 426</td>
<td>Advanced Biomedical Equipment Technology</td>
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<td></td>
<td>A minimum of 1 unit from the following:</td>
<td>1</td>
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<tr>
<td>ET 260</td>
<td>Introduction to Medical Ultrasound Equipment  (0.5)</td>
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<tr>
<td>ET 261</td>
<td>Introduction to Biomedical Equipment Networking (0.5)</td>
<td></td>
</tr>
<tr>
<td>ET 262</td>
<td>Introduction to Respiratory Therapy Ventilators (0.5)</td>
<td></td>
</tr>
<tr>
<td>ET 263</td>
<td>Introduction to Medical X-ray Imaging Equipment (1)</td>
<td></td>
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<td></td>
<td>Total Units:</td>
<td>20</td>
</tr>
</tbody>
</table>

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 electrosurgical 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 electrosurgical 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 Information

This program prepares electronics technology students for a biomedical technician internship or trainee position.

Digital Home Technology Integration 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.

Certificate Requirements

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<thead>
<tr>
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<tbody>
<tr>
<td>ET 115</td>
<td>Fiber Optics and Telecommunication Cabling</td>
<td>4</td>
</tr>
<tr>
<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
<td>4</td>
</tr>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>ET 385</td>
<td>Digital Home Technology Integration</td>
<td>4</td>
</tr>
<tr>
<td>ET 388</td>
<td>Fiber Optics</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Total Units:</td>
<td>20</td>
</tr>
</tbody>
</table>

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 home 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 Information

This certificate prepares individuals to design, install, and support residential networks and home integration for employment in the home technology industry. It develops the technicians’ ability to configure, integrate, maintain, and troubleshoot home theater, music, security, and home networks.

Digital Repair and Upgrade Technician Certificate

This 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.
Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>UNITS</th>
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</thead>
<tbody>
<tr>
<td>CISC 320</td>
<td>Operating Systems</td>
<td>1</td>
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<tr>
<td>CISC 361</td>
<td>Microcomputer Support Essentials - Preparation for A+ Certification</td>
<td>3</td>
</tr>
<tr>
<td>CISC 363</td>
<td>Microcomputer Support Technical - Preparation for A+ Certification</td>
<td>3</td>
</tr>
<tr>
<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
<td>4</td>
</tr>
<tr>
<td>ET 298</td>
<td>Work Experience in Electronics Technology</td>
<td>1 - 4</td>
</tr>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>ET 308</td>
<td>Technical Soldering Practices and Techniques</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Units: 18 - 21

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.
- describe the terminology used for working with personal computers.
- categorize the components inside a personal computer.
- upgrade and install new and updated software programs.
- research 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.
- differentiate resistance, capacitance and inductive devices and their operating characteristics.
- analyze and troubleshoot basic electronic circuits.
- research and interpret basic electronic components using manufacturers’ data manuals, library resources, and the Internet.

Career Information

This 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.

Electronic Systems Technology Certificate

This certificate combines broad-based electronic and telecommunications training with specialty areas such as robotics, fiber optics, programmable interface controllers (PICs), and stamp micro-controllers.

Catalog Date: June 1, 2020

Certificate Requirements

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<td>ET 308</td>
<td>Technical Soldering Practices and Techniques</td>
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<tr>
<td>ET 312</td>
<td>Mathematics for Circuit Analysis</td>
<td>3</td>
</tr>
<tr>
<td>ET 322</td>
<td>Semiconductors and Nanotechnology</td>
<td>4</td>
</tr>
<tr>
<td>ET 381</td>
<td>Electronic Communication Regulations</td>
<td>3</td>
</tr>
<tr>
<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
<td>4</td>
</tr>
<tr>
<td>ET 335</td>
<td>Integrated Circuits with Computer Applications</td>
<td>4</td>
</tr>
<tr>
<td>ET 380</td>
<td>Introduction to Electronic Communications</td>
<td>4</td>
</tr>
<tr>
<td>ET 420</td>
<td>Microcontrollers and Digital Signal Processors</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Units: 36

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 electronics technology.
- calculate the mathematical relationships among voltage, current, resistance, capacitance, inductance, reactance, frequency, and phase angle as they relate to electronic circuits.
- analyze aviation, marine, and commercial communication systems that are covered in the FCC General Class Radiotelephone license examination.
- analyze working and defective electronic circuits by interpreting data from a variety of test and measurement equipment.
- differentiate and diagram schematic symbols used in electronic and electrical industrial applications.
- use common hand tools in the mechanical installation of copper and fiber optic cabling used in sophisticated communication systems.
- research and interpret basic electronic components using manufacturers’ data manuals, library resources, and the Internet.
- evaluate electrical parameters using various types of test and measurement equipment used in the analysis of power supply, amplifier, and general electronic circuits.

Career Information

This 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.

Fiber Optics Certificate

This certificate is an introduction to 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.

Catalog Date: June 1, 2020

Certificate Requirements
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 Information

This certificate prepares students for 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.

Mechatronics Certificate

This certificate provides training in a multi-disciplinary field focusing on industrial automation. Topics include electricity, electronics, industrial motor controls, programmable logic controllers, robotics, AC/DC drives, mechanical design, and manufacturing technologies.

Catalog Date: June 1, 2020

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>UNITS</th>
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<tbody>
<tr>
<td>DESIGN 301</td>
<td>Introduction to Computer Aided Drafting and Design (CADD)</td>
<td>3</td>
</tr>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>WELD 300</td>
<td>Introduction to Welding</td>
<td>3</td>
</tr>
<tr>
<td>ET 197</td>
<td>Introduction to Mechatronics</td>
<td>4</td>
</tr>
<tr>
<td>DESIGN 302</td>
<td>Technical Documentation with CADD (3)</td>
<td>3</td>
</tr>
<tr>
<td>or ENGR 312</td>
<td>Engineering Graphics (3)</td>
<td></td>
</tr>
<tr>
<td>ET 193</td>
<td>Introduction to Robotics and Sensors</td>
<td>4</td>
</tr>
<tr>
<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
<td>4</td>
</tr>
<tr>
<td>Total Units:</td>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>

Student Learning Outcomes

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

- integrate the principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply industry-appropriate design techniques to develop technical design documents from a conceptual design.
- design robotic and machine automation systems using mechatronic principles.
- evaluate welding projects in accordance with welding procedures and specifications.
- contrast DC, AC, brushless, serve, and stepper motor operation.
- create technical documentation/presentations of models from the mechanical engineering discipline in both technically correct and visually pleasing solid, orthographic, and section view formats.
- design programmable logic controller (PLC) programs demonstrating input/output capabilities.
- design programs for an operator interface terminal (OIT) demonstrating input/output capabilities.

Career Information

This certificate prepares students 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, and mechanical electrical machine systems installer.

Robotics Certificate

The certificate provides an overview of the application, programming, and design of robotic systems and components. It covers the theory and application of electronics, sensors, controllers, and robots. Various robotic platforms are used to give a wide understanding of all types of current and future systems.

Catalog Date: June 1, 2020

Certificate Requirements

<table>
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<tbody>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
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<tr>
<td>ET 197</td>
<td>Introduction to Mechatronics</td>
<td>4</td>
</tr>
<tr>
<td>ET 198</td>
<td>Introduction to Robotics and Sensors</td>
<td>4</td>
</tr>
<tr>
<td>Total Units:</td>
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<td>12</td>
</tr>
</tbody>
</table>

Student Learning Outcomes

Upon completion of this program, the student will be able to:
- identify and describe the terminology used when working with microcontrollers.
- program a microcontroller.
- compare brushed DC, brushless DC, stepper, and RC servo motor characteristics.
- construct and program mobile and pick-and-place robots.
- describe the principles of sensors used to measure pressure and temperature.
- create simple electronic schematics using basic schematic symbols.
- analyze and troubleshoot basic electronic circuits.
- diagnose simple circuit failures with standard electronic measurement devices.
- design a PLC Logic circuit demonstrating input/output capabilities and timer and counter operation.

Career Information

This certificate may lead to careers in the following: robotics technician, manufacturing technician, automated warehouse technician, and facilities technician.

Telecommunication Specialist Certificate

This 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.

Catalog Date: June 1, 2020

Certificate Requirements

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<tbody>
<tr>
<td>ET 115</td>
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<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
</tr>
<tr>
<td>ET 308</td>
<td>Technical Soldering Practices and Techniques</td>
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<td>ET 312</td>
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<td>Semiconductors and Nanotechnology</td>
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<td>ET 381</td>
<td>Electronic Communication Regulations</td>
<td>3</td>
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<td>ET 253</td>
<td>Industrial Communication Systems Support</td>
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<tr>
<td>ET 380</td>
<td>Introduction to Electronic Communications</td>
<td>4</td>
</tr>
<tr>
<td>ET 388</td>
<td>Fiber Optics</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Units: 32

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 Information

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

Certificates

Basic Electronics and Telecommunications Certificate

This 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. This certificate can be completed in one semester, making it an ideal stepping stone to the Advanced Electronics and Telecommunications certificate.

Catalog Date: June 1, 2020

Certificate Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>UNITS</th>
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</thead>
<tbody>
<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
<td>4</td>
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<tr>
<td>A minimum of 5 units from the following:</td>
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<td></td>
</tr>
<tr>
<td>ET 115</td>
<td>Fiber Optics and Telecommunication Cabling</td>
<td></td>
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<tr>
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<td>Mathematics for Circuit Analysis</td>
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### Electronics Technology (ET) Courses

#### ET 101 Introduction to Amateur Radio

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

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 115 Fiber Optics and Telecommunication Cabling

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

### Basic Mechatronics Certificate

This certificate provides introductory training in the multidisciplinary field of mechatronics, which combines mechanical and electronic technologies. Topics include introductory courses in electronics, programmable logic controllers, basic CAD design, and welding.

#### Certificate Requirements

<table>
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<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
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<tr>
<td>DESIGN 301</td>
<td>Introduction to Computer Aided Drafting and Design (CADD)</td>
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<tr>
<td>ET 197</td>
<td>Introduction to Mechatronics</td>
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<tr>
<td>ET 302</td>
<td>Principles of Electricity and Electronics</td>
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<tr>
<td>WELD 300</td>
<td>Introduction to Welding</td>
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**Total Units:** 14

#### Student Learning Outcomes

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

- integrate the basic principles of mechanical, electronic, and electrical technologies into the design of mechatronic systems.
- evaluate mechanical and electrical solutions to technological problems.
- apply basic design techniques to develop technical design documents.
- design basic robotic and machine automation systems using mechatronic principles.
- create and evaluate welding projects in accordance with welding procedures and specifications.

#### Career Information

This certificate prepares students for internships and entry-level employment with local industries using mechatronic and design principles.
This course introduces the concepts of telecommunication cable installation and connection practices and standards. It includes the study of commonly used fiber optic and copper cable types and connectors, installation tools, and test equipment. It emphasizes installation techniques in practical situations. Laboratory activities provide practical hands-on experience in the operation and use of tools and test equipment specific to the telecommunication industry. Field trips may be required.

**ET 193 Introduction to Robotics and Sensors**

**Units:** 4  
**Hours:** 54 hours LEC; 54 hours LAB  
**Catalog Date:** June 1, 2020

This course is an introduction to robotics, controllers, and sensors. Topics include the operation and design of robots and sensors, hardware component selection, assembly, and software programming of various types of sensors and robotic assemblies. Field trips may be required.

**ET 197 Introduction to Mechatronics**

**Units:** 4  
**Hours:** 54 hours LEC; 54 hours LAB  
**Prerequisite:** ET 302 with a grade of "C" or better  
**Catalog Date:** June 1, 2020

This course introduces mechatronics, the combination of electronic and mechanical components and systems used in the control and transmission of mechanical power. Topics include the analysis of electric controls, programmable logic controllers (PLCs), electromagnetic devices, sensors, pneumatic devices, and electric motors.

**ET 250 Employability Skills for Technical Careers**

**Same As:** AT 107 and WELD 150  
**Units:** 2  
**Hours:** 36 hours LEC  
**Prerequisite:** None.  
**Advisory:** ENGW 102 or 103, and ENGRD 116 with a grade of "C" or better; OR ESLR 320, ESLL 320, and ESLW 320 with a grade of "C" or better.  
**General Education:** AA/AS Area III(b)  
**Catalog Date:** June 1, 2020

This course provides the opportunity to explore technical careers while developing valuable work and life skills. It is an introduction to a variety of technically-related occupations, emphasizing technical careers in the Sacramento area. Activities are designed to enhance personal development, employability skills, and self esteem through leadership, citizenship, and character development. This course is not open to students who have completed AT 107 or WELD 150.

**ET 253 Industrial Communication Systems Support**

**Units:** 4  
**Hours:** 54 hours LEC; 54 hours LAB  
**Prerequisite:** ET 302 with a grade of "C" or better  
**Catalog Date:** June 1, 2020

This course covers the operation, repair, and assembly of personal computers (PC), portable test units (PTU), and communication systems. Safety, terminology, component identification, file management, industry specific hardware and software, and upgrades in industry are among the topics covered. Wired, wireless, voice over Internet protocol (VoIP), analog/digital communications, and synchronous optical networks (SONET) are also covered. Field trips may be required.

**ET 260 Introduction to Medical Ultrasound Equipment**

**Units:** 0.5  
**Hours:** 9 hours LEC  
**Prerequisite:** None.  
**Corequisite:** ET 425  
**Catalog Date:** June 1, 2020

This course provides in-depth training for maintaining ultrasound equipment used in the biomedical field. It covers imaging modes, physical principles, transducers, system block diagrams, common peripherals, Doppler effect, image quality, test equipment, and troubleshooting.

**ET 261 Introduction to Biomedical Equipment Networking**

**Units:** 0.5  
**Hours:** 9 hours LEC  
**Prerequisite:** None.  
**Advisory:** ET 253 and 302;  
**Catalog Date:** June 1, 2020

This course provides an overview of the Digital Information Communication of Medicine (DICOM) system. DICOM is a patient data system for medical devices to communicate with the hospital database. Topics include interface standards, test equipment, troubleshooting, and applications.

**ET 262 Introduction to Respiratory Therapy Ventilators**

**Units:** 0.5  
**Hours:** 9 hours LEC  
**Prerequisite:** None.  
**Corequisite:** ET 426  
**Catalog Date:** June 1, 2020

This course provides in-depth training for the maintenance of respiratory ventilation machines used in the biomedical field. It covers respiratory ventilator basics, ventilator block diagrams, patient circuits, test equipment, and troubleshooting.

**ET 263 Introduction to Medical X-ray Imaging Equipment**

**Units:** 1  
**Hours:** 18 hours LEC  
**Prerequisite:** ET 425 with a grade of "C" or better  
**Catalog Date:** June 1, 2020

This course provides an introduction to the maintenance of medical X-ray imaging equipment. It covers X-ray generators, components of vacuum tube and solid state imaging chains, cameras, digitizing methods, processing, display methods, and radiation safety.
ET 294 Topics in Electronics Technology

Units: 0.5 - 5
Hours: 9 - 90 hours LEC; 27 - 270 hours LAB
Prerequisite: None.
Catalog Date: June 1, 2020

This is an individualized course developed in cooperation with industry to meet specialized training needs. It may be taken four times with no duplication of topics.

ET 295 Independent Studies in Electronics Technology

Units: 1 - 3
Hours: 54 - 162 hours LAB
Prerequisite: None.
Catalog Date: June 1, 2020

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

ET 298 Work Experience in Electronics Technology

Units: 1 - 4
Hours: 60 - 300 hours LAB
Prerequisite: None.
Catalog Date: June 1, 2020

This course provides students with opportunities to develop marketable skills in preparation for employment or advancement within the electronics industry. It is designed for students interested in work experience and/or internships in associate degree level or certificate occupational programs. Course content includes understanding the application of education to the work force, completion of Title 5 required forms which document the student's progress and hours spent at the work site, and developing workplace skills and competencies.

During the semester, the student is required to complete 75 hours of related paid work experience, or 60 hours of related unpaid work experience for one unit. An additional 75 or 60 hours of related work experience is required for each additional unit. All students are required to attend the first class meeting, a mid-semester meeting, and a final meeting. Additionally, students who have not already successfully completed a Work Experience course will be required to attend weekly orientations while returning participants may meet individually with the instructor as needed. Students may take up to 16 units total across all Work Experience course offerings. This course may be taken up to four times when there are new or expanded learning objectives. Only one Work Experience course may be taken per semester.

ET 299 Experimental Offering in Electronics Technology

Units: 0.5 - 4
Prerequisite: None.
Catalog Date: June 1, 2020

ET 302 Principles of Electricity and Electronics

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

This introductory course explores the field of electronics and electricity. Topics include the theory of AC, DC, Ohm's law, inductance, and capacitance. Theory is reinforced through the use of electronic simulation software and hands-on lab experiments using industry instruments. Field trips to local electronics industries may be required.

ET 308 Technical Soldering Practices and Techniques

Units: 2
Hours: 18 hours LEC; 54 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

This course provides training in the standards, processes, and techniques related to the field of lead and lead-free soldering. It emphasizes the differences between lead and lead-free soldering processes. Topics include safety, Electrostatic Discharge (ESD), Printed Circuit Board (PCB) components and assembly, electronic components and identification, lead and lead-free soldering and desoldering techniques in Plated Through Hole (PTH), Surface Mount Device/Technology (SMD/SMT), and fine to ultra-fine pitch soldering. Field trips may be required.

ET 309 Soldering and Cabling Quality Standards

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

This course covers Interconnecting and Packaging Council (IPC) standards for the inspection and evaluation of printed circuit boards and cable assemblies used in the electronics industry. It prepares students to take the tests for IPC Electronic Circuits Specialist and Certified IPC Application Specialist certifications. Field trips may be required.

ET 312 Mathematics for Circuit Analysis

Units: 3
Hours: 54 hours LEC
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

This course covers the foundations of the analysis of electrical and electronic circuits. It includes the analysis of direct current (DC), alternating current (AC), transformer, capacitor, inductor, and energy conversion circuits.
ET 322 Semiconductors and Nanotechnology

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

This course covers integrated circuits (ICs) 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 369 The Design and Fabrication of Electronics Projects

This course provides an opportunity to design and build advanced projects. It includes work on approved electronics projects outside the scope of typical classroom applications. It covers the process of planning, design, prototyping, and fabrication while building an actual working project. Completed projects are entered in county and statewide technology contests 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.

ET 380 Introduction to Electronic Communications

This course covers electronic communications including 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 may be required.

ET 381 Electronic Communication Regulations

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

ET 385 Digital Home Technology Integration

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 may be required.
ET 388 Fiber Optics

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: ET 302 with a grade of "C" or better
Advisory: ET 380
Transferable: CSU
Catalog Date: June 1, 2020

This course in fiber optics covers optical theory and operation including the complete fiber optic communication system. It includes fiber optic terminology and instruction in the 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 reflectometers (OTDR). It also includes system design and troubleshooting procedures. A field trip may be required.

ET 420 Microcontrollers and Digital Signal Processors

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
Corequisite: ET 335
Transferable: CSU
Catalog Date: June 1, 2020

This course is an in-depth study of microcontrollers and digital signal processors (DSP). It focuses 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 421 Advanced Electronic Communications

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: ET 253 and 380 with grades of "C" or better
Transferable: CSU
Catalog Date: June 1, 2020

This course covers advanced analog and digital electronic communications including digital two-way radio, cellular, microwave, satellite, and broadcast communications. Topics include digital radio frequency theory, digital transmitters and receivers, P25 digital radio, antennas, software-defined radios, and related industry test equipment.

Field trips may be required.

ET 425 Introduction to Biomedical Equipment Technology

Units: 4
Hours: 72 hours LEC
Prerequisite: ET 302 with a grade of "C" or better
Transferable: CSU
Catalog Date: June 1, 2020

This course covers the fundamentals 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 theory, 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

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: ET 425 with a grade of "C" or better
Transferable: CSU
Catalog Date: June 1, 2020

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

Units: 2
Hours: 108 hours LAB
Prerequisite: ET 335 or 380 with a grade of "C" or better
Transferable: CSU
Catalog Date: June 1, 2020

This course provides an opportunity for students to pursue advanced electronics projects to learn and practice skills needed in the construction, installation, maintenance, and repair of electronic devices.

ET 495 Independent Studies in Electronics Technology

Units: 1 - 3
Hours: 54 - 162 hours LAB
Prerequisite: None.
Transferable: CSU
Catalog Date: June 1, 2020

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.
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