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.

Roadmaps

Road maps lay out all of the courses you need to take for a given degree or certificate.

Get a Road map! Explore Ways to Complete These Programs (/academics/arc-program-road-maps)

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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

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

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
First Semester:		
DESGN 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:		
DESGN 302	Technical Documentation with CADD (3)	3
or ENGR 312	Engineering Graphics (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, servo, 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.

Catalog Date: June 1, 2020

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
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)	
or ET 335	Integrated Circuits with Computer Applications (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.

Catalog Date: June 1, 2020

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
ET 302	Principles of Electricity and Electronics	4
ET 312	Mathematics for Circuit Analysis	3
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)	
Total Units:		20

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.

Catalog Date: June 1, 2020

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 253	Industrial Communication Systems Support	4
ET 302	Principles of Electricity and Electronics	4
ET 385	Digital Home Technology Integration	4
ET 388	Fiber Optics	4
Total Units:		20

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.

Catalog Date: June 1, 2020

Certificate Requirements

COURSE CODE	COURSE TITLE	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 253	Industrial Communication Systems Support	4
ET 298	Work Experience in Electronics Technology	1-4
ET 302	Principles of Electricity and Electronics	4
ET 308	Technical Soldering Practices and Techniques	2
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

COURSE CODE	COURSE TITLE	UNITS
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
ET 381	Electronic Communication Regulations	3
ET 253	Industrial Communication Systems Support	4
ET 335	Integrated Circuits with Computer Applications	4
ET 380	Introduction to Electronic Communications	4
ET 420	Microcontrollers and Digital Signal Processors	4
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

COURSE CODE	COURSE TITLE	UNITS
ET 115	Fiber Optics and Telecommunication Cabling	4
ET 302	Principles of Electricity and Electronics	4
ET 388	Fiber Optics	4
Total Units:		12

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

COURSE CODE	COURSE TITLE	UNITS
DESGN 301	Introduction to Computer Aided Drafting and Design (CADD)	3
ET 302	Principles of Electricity and Electronics	4
WELD 300	Introduction to Welding	3
ET 197	Introduction to Mechatronics	4
DESGN 302	Technical Documentation with CADD (3)	3
or ENGR 312	Engineering Graphics (3)	
ET 193	Introduction to Robotics and Sensors	4
ET 253	Industrial Communication Systems Support	4
Total Units:		25

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, servo, 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

COURSE CODE	COURSE TITLE	UNITS

ET 302	Principles of Electricity and Electronics	4
ET 197	Introduction to Mechatronics	4
ET 193	Introduction to Robotics and Sensors	4
Total Units:		12

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.
- calculate speed and acceleration of robotic motion.
- 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

COURSE CODE	COURSE TITLE	UNITS
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
ET 381	Electronic Communication Regulations	3
ET 253	Industrial Communication Systems Support	4
ET 380	Introduction to Electronic Communications	4
ET 388	Fiber Optics	4
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

COURSE CODE	COURSE TITLE	UNITS
ET 302	Principles of Electricity and Electronics	4
A minimum of 5 units from the following:		5
ET 115	Fiber Optics and Telecommunication Cabling (4)	
ET 308	Technical Soldering Practices and Techniques (2)	
ET 312	Mathematics for Circuit Analysis (3)	
Total Units:		9

Student Learning Outcomes

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

- evaluate potential problems associated with electrostatic discharge (ESD).
- assess safety hazards when working with electronic systems.
- create simple electronic schematics using basic schematic symbols.
- construct, analyze, and troubleshoot basic electronic circuits.
- apply electrical concepts to measure and evaluate resistance, capacitance, and inductive devices and circuits.
- synthesize and analyze electronic circuitry using computer electronic-simulation software.
- diagnose simple circuit failures with basic electronic measurement devices.
- assemble electronic circuits using basic soldering techniques.
- solve mathematical and algebraic problems as applied to electronic circuits.
- apply Ohm's, Watt's, and Kirchhoff's laws to determine and analyze circuit operating characteristics.

Career Information

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.

Catalog Date: June 1, 2020

Certificate Requirements

COURSE CODE	COURSE TITLE	UNITS
DESGN 301	Introduction to Computer Aided Drafting and Design (CADD)	3
ET 197	Introduction to Mechatronics	4
ET 302	Principles of Electricity and Electronics	4
WELD 300	Introduction to Welding	3
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.

Electronics Technology (ET) Courses

ET 101 Introduction to Amateur Radio

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

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

Student Learning Outcomes

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

- explain the fundamental purpose for amateur radio services.
- diagram a typical amateur radio setup.
- describe the typical method to contact and disconnect from an amateur radio station.

- describe the licensing requirements for an amateur radio license.

ET 103 Ham Radio Technician License Preparation

Units: 2
Hours: 36 hours LEC
Prerequisite: None.
Catalog Date: June 1, 2020

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.

Student Learning Outcomes

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

- list the fundamental purposes of Amateur Radio Services.
- solve basic problems using Ohm's Law and problems involving frequency, wavelength, and power.
- describe basic electronic components such as resistors, capacitors, inductors, transistors, diodes, and integrated circuits.
- describe the concepts of modulation and demodulation.
- describe basic types of radio wave propagation.
- describe the basic functions of dipole, ground plane, and beam antennas.
- recognize the symptoms of receiver overload, over and under modulation, distortion, radio frequency (RF) feedback, off frequency signal fading, and noise.
- recognize electrical, radiation, and lightning hazards associated with transmitters and antennas.

ET 115 Fiber Optics and Telecommunication Cabling

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

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.

Student Learning Outcomes

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

- analyze and describe the components of a complete telecommunication system.
- assemble and construct connectors and plugs used in telecommunication systems.
- design an office building telecommunication system using copper cable.
- inspect and repair, if necessary, copper cable connections and installations.
- employ common hand tools in the mechanical and electrical installation of a communication system.
- analyze test equipment data to determine the location of a communication system failure.
- identify and describe the use of tools and test equipment necessary for fiber optic and copper cable installations.
- identify safety hazards when working with telecommunication systems.
- evaluate communication system components and select the best equipment for a given application.

ET 193 Introduction to Robotics and Sensors

Units: 4
Hours: 54 hours LEC; 54 hours LAB
Prerequisite: None.
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.

Student Learning Outcomes

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

- apply the rules of electrical safety and work envelope dangers.
- identify and describe the terminology used when working with robots and sensors.
- diagnose robot hardware and software problems.
- describe the principles of pressure, pressure indicators, and pressure transducers.
- compare the principles of temperature, temperature indicators, and temperature transducers.
- identify robot end-effectors used to accomplish special tasks.
- list the different detection methods used to sense objects.
- evaluate the increased complexity and usefulness of robots through history.
- identify the physical construction of robotic bases and carriers.
- compare DC, stepper, and servo motor characteristics.

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.

Student Learning Outcomes

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

- differentiate open- and closed-loop electrical control methods.
- describe and diagram a PLCs architecture.
- design a PLC Logic circuit demonstrating input/output capabilities and timer and counter operation.
- contrast DC (direct current), AC (alternating current), and stepper motor operation.
- compare digital sensor technologies.
- differentiate and diagram pneumatic power systems.
- compare pneumatic schematic symbols and analyze the operation of pneumatic valves and actuators.
- diagnose PLC hardware and software issues.

ET 250 Employability Skills for Technical Careers

Same As:	AT 107 and WELD 150
Units:	2
Hours:	36 hours LEC
Prerequisite:	None.
Advisory:	ENGWR 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.

Student Learning Outcomes

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

- identify personal interests.
- demonstrate effective communication skills.
- demonstrate personal qualities that are desirable in the workplace.
- create long-term and short-term goals.

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.

Student Learning Outcomes

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

- support electrostatic discharge (ESD) safety devices and procedures.
- evaluate the major components inside a PTU.
- set up, install, and configure a hard drive to meet industry specifications.
- diagnose computer memory modules and industry-specific cards.
- test upgraded and installed software programs.
- plan, download, install, configure, and test updated system drivers.
- evaluate different features of cable and digital subscriber line (DSL) modems.
- choose common hardware and software test systems for troubleshooting and repair of PTUs.
- research and evaluate electronic communications equipment.
- set up test media and voice communication systems.
- set up and configure security and surveillance systems.
- assess Internet protocol (IP) based measurement setup and control systems using static and dynamic IP addresses.
- evaluate wireless fidelity (Wi-Fi) and VoIP systems.

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.

Student Learning Outcomes

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

- compare ultrasound transducers that convert physiological properties to electrical signals.

- configure standard electrical measurement tools and differentiate the uses for calibration and troubleshooting of ultrasound equipment.
- diagnose typical failures of transducers from displayed waveforms.
- compare standard and Doppler ultrasound technologies.
- create a block diagram and list the different components, transducers, signal processing circuits, and displays used in ultrasound equipment.

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.

Student Learning Outcomes

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

- compare DICOM networking protocols.
- set up standard and specialized electrical measurement tools for the testing and troubleshooting of medical networks.
- diagram a typical medical equipment network.
- create a network interface cabling diagram including color codes and connector types.
- list typical test equipment used for DICOM communication troubleshooting.

ET 262 Introduction to Respiratory Therapy Ventilators

Units:	0.5
Hours:	9 hours LEC
Prerequisite:	None.
Corequisite:	ET 425
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.

Student Learning Outcomes

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

- diagram the patient circuit for a respiratory ventilator.
- demonstrate the use of standard electrical measurement tools.
- differentiate the uses of electronic instruments for calibration and troubleshooting of respiratory ventilator equipment.
- diagnose typical failures of respiratory ventilators.
- create a block diagram and list the different components, transducers, signal processing circuits, and displays used in respiratory ventilation equipment.

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.

Student Learning Outcomes

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

- differentiate types of X-ray and nuclear medicine equipment used for diagnostic purposes.
- set up standard electrical measurement tools and specialized instruments for the calibration and troubleshooting of X-ray equipment.
- diagnose typical failures of X-ray imaging equipment.
- create a block diagram and list the different components used in the imaging system.
- describe the dangerous health effects from the exposure of X-rays and nuclear radiation.
- diagram typical vacuum tube and digital X-ray generators.
- differentiate legacy film displays from digital imaging systems.

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.

Student Learning Outcomes

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

- Apply the rules of electrical safety when working with stamp microcontrollers.

- Identify and describe the terminology used when working with stamp microcontrollers.
- Safely work with line voltage components that are interfaced to stamp microcontrollers.
- Demonstrate the proper use of Electro Static Discharge(ESD) precautions when working with stamp microcontrollers.
- Program and troubleshoot the stamp microcontroller using P-Basic language.
- Identify and properly name the internal components that make up the stamp microcontroller.
- Demonstrate the assembly of the Parallax Boe-Bot kit.
- Download updated microcontroller software from Parallax.
- Program the Parallax Boe-Bot for various robotic tasks.

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.
Enrollment Limitation:	Students must be in a paid or unpaid internship, volunteer position, or job related to the electronics industry with a cooperating site supervisor. Students are advised to consult with the Electronics Technology Department faculty to review specific certificate and degree work experience requirements.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
General Education:	AA/AS Area III(b)
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 workforce, 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.

Student Learning Outcomes

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

- demonstrate mastery of specific job skills in the electronics industry related to an associate degree or certificate occupational program level career as written in the minimum three (3) learning objectives created by the student and his/her employer or work site supervisor at the start of the course.
- make effective decisions, use workforce information, and manage his/her personal career plans.
- behave professionally, ethically, and legally at work, consistent with applicable laws, regulations, and organizational norms.
- behave responsibly at work, exhibiting initiative and self-management in situations where it is needed.
- apply effective leadership styles at work, with consideration to group dynamics, team and individual decision making, and workforce diversity.
- communicate in oral, written, and other formats, as needed, in a variety of contexts at work.
- locate, organize, evaluate, and reference information at work.
- demonstrate originality and inventiveness at work by combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities using critical and creative thinking skills such as logical reasoning, analytical thinking, and problem-solving.

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.

Student Learning Outcomes

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

- create simple electronic schematics using basic schematic symbols.
- analyze and troubleshoot basic electronic circuits.
- apply electrical concepts to measure and evaluate resistance, capacitance, and inductive devices.
- compare and contrast series and parallel resistive, capacitance, and inductive circuits.
- synthesize and analyze electronic circuitry using computer electronic-simulation software.
- diagnose simple circuit failures with standard electronic measurement devices.
- assemble electronic circuits using basic soldering techniques.

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.

Student Learning Outcomes

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

- differentiate, set up, and operate a wide variety of soldering and desoldering equipment, workstations, and fixtures that may require visual observation
- describe the difference between lead and lead-free soldering processes, plated through hole and surface mount technology, and various soldering wire and fluxes
- recognize, prepare for, and prevent potential problems associated with electrostatic discharge (ESD)
- inspect and evaluate solder connections in accordance with industry standards
- identify quality soldering and correct defective solder connections
- compile and assemble materials required for soldering electronic circuit components
- demonstrate the skill of soldering and desoldering under varying conditions

ET 309 Soldering and Cabling Quality Standards

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Advisory:	ET 115 and 308
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.

Student Learning Outcomes

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

- describe the purpose and application of IPC-A-610E (A-standard) Certified Interconnecting and Packaging (IPC) Electronic Circuits Specialist and IPC-J-STD-001E (J-standard) Certified IPC Application Specialist certifications.
- describe the purpose and application of the IPC/WHMA-A-620 (A-620 Standard) requirements and acceptance for cable and wire harness assemblies certifications.
- identify the materials, components, and requirements to meet the standards of the IPC J-standard and A-standard.
- describe hardware installation for wire and terminals, plated through-hole technology (PTHT) components, and surface mount technologies (SMT) components to meet the IPC J-STD-001 J-standard and IPC A-standard.
- describe the general soldered connection acceptance requirements for PTHT and SMT connections including lead and lead-free solder.
- describe the test methods and related standards including statistical process control methodology and inspection skills to meet the IPC standards.
- describe cable and wire preparation, measuring cable assemblies, wire bundle securing, shielding, and protective coverings to meet the IPC A-620 standard.

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 for 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.

Student Learning Outcomes

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

- solve mathematical and algebraic problems as applied to electronic circuits.
- apply Ohm's, Watt's, and Kirchhoff's laws to determine and analyze circuit operating characteristics.
- analyze and organize data into graphs and perform simple transformations.
- demonstrate the operation of a scientific calculator for solving math, word, and circuit problems.
- evaluate the operating parameters of voltage and current divider circuits.
- analyze and interpret the mathematical relationships between voltage, current, resistance, capacitance, inductance, reactance, frequency, and phase angle as they relate to AC circuits.
- calculate voltage, current, power, turns, and impedance ratios for transformers.
- evaluate resistor-inductor (RL) and resistor-capacitor (RC) circuits and time constants.

ET 322 Semiconductors and Nanotechnology

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	ET 302 with a grade of "C" or better
Corequisite:	ET 312
Transferable:	CSU
Catalog Date:	June 1, 2020

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.

Student Learning Outcomes

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

- compare the physical construction and theory of operation of junction diodes, bipolar junction transistors, field effect transistors, and operational amplifiers.
- troubleshoot linear and switch-mode power supplies.
- diagnose amplifier, power supply, and driver circuit problems.
- calculate theoretical operating characteristics and compare to measured results on operating amplifier circuits.
- diagram and label the functional blocks of amplifiers and power supplies.
- interpret schematic diagrams and formulate solutions to problems in electronic circuitry.
- assess data from a variety of test and measurement equipment used in the analysis of power supply, and amplifier circuits.
- describe basic nanotechnology building blocks and their possible uses.
- design and simulate circuits in software.
- construct and test circuits on prototyping boards and printed circuit boards.

ET 335 Integrated Circuits with Computer Applications

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

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.

Student Learning Outcomes

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

- operate an oscilloscope and a variety of measurement equipment to measure and interpret electrical signals.
- analyze schematic diagrams.
- evaluate a signal through a circuit using a schematic diagram and an oscilloscope.
- compare the schematic symbol, truth-table, and theory of operation of the seven basic logic gates.
- generate decoder circuits from logic gates and evaluate the output of decoder circuits.
- convert logic circuits to Boolean equations.
- convert Boolean equations to logic circuits.
- analyze and simplify Karnaugh maps from Boolean equations.
- compare the schematic symbol, truth-table, and theory of operation of the three basic latches.
- design and evaluate decoder display circuits.
- analyze the operation of "divide by n" counter circuits.
- design timer circuits using the 555 timer and RC circuits.
- construct and evaluate analog-to-digital converters.
- compare the operational characteristics of digital devices.

ET 369 The Design and Fabrication of Electronics Projects

Units:	2
Hours:	18 hours LEC; 54 hours LAB
Prerequisite:	ET 322 with a grade of "C" or better
Transferable:	CSU
Catalog Date:	June 1, 2020

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.

Student Learning Outcomes

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

- plan and design an electronics project that is marketable or meets a need of society.
- build an electronics project to meet industry specifications.
- assemble a working electronics model using commercially and custom fabricated components.
- research material and components using manufacturers' data books and the Internet.
- fabricate plastic, metal, and composite parts for an electronics project.
- design electrical circuits using computer simulation software.
- prepare a list of materials, a cost spreadsheet, and an estimate of manufacturing costs.
- create a clear and concise operation or instruction manual that would enable someone with no engineering background to successfully operate the project.
- prepare and present an industry-style presentation on the design, application, and manufacturing of the project.

ET 380 Introduction to Electronic Communications

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

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.

Student Learning Outcomes

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

- operate a variety of major electronic circuits used in communication equipment.
- analyze and troubleshoot various problems in electronic communication circuits.
- perform repairs and adjustments to electronic communication systems to operate at factory specifications.
- design and build several common circuits used in electronic communication systems.
- diagnose problems in electronic communication systems.

ET 381 Electronic Communication Regulations

Units:	3
Hours:	54 hours LEC
Prerequisite:	None.
Advisory:	ET 312, 322, or 380
Transferable:	CSU
Catalog Date:	June 1, 2020

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.

Student Learning Outcomes

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

- describe the requirements for the FCC General Class Radiotelephone license.
- differentiate maritime and international law and operating procedures.
- apply alternating current (AC) and direct current theory.
- apply basic semiconductor principles for diodes and transistors.
- apply operational amplifier and digital theory.
- apply receiver and transmitter theory.
- apply antenna theory.
- apply aircraft navigation equipment theory.
- apply marine navigation equipment theory.

ET 385 Digital Home Technology Integration

Units:	4
Hours:	54 hours LEC; 54 hours LAB
Prerequisite:	ET 115 with a grade of "C" or better
Transferable:	CSU
Catalog Date:	June 1, 2020

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.

Student Learning Outcomes

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

- analyze and describe the components in a Home Technology Integration (HTI) system.
- design a complete HTI system according to factory specifications.
- assess safety hazards when working with HTI systems.
- analyze test equipment data to determine the location of a HTI system failure.

- evaluate HTI components and select the best for a given application.
- identify and describe the use of tools and test equipment necessary for HTI system installations.
- inspect and repair, if necessary, existing HTI system installations.

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.

Student Learning Outcomes

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

- analyze and describe the components in a complete fiber optic communication system.
- analyze and troubleshoot basic fiber optic system problems.
- compare fiber optic component specifications using manufacturers' data manuals, reference books, and the Internet.
- calculate the losses and gains in a complete fiber optic communication system.
- contrast the differences between a fusion splice and a mechanical splice.
- evaluate ST fiber optic jumper cables using a laser source and an optical power meter.
- contrast the differences between ST, SC, and FC fiber optic connectors.
- calculate the attenuation of a complete fiber optic communication system.
- assess safety hazards when working with fiber optic systems.
- compose a parts list for a typical fiber optic system installation.
- design a complete operational fiber optic communication system.

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.

Student Learning Outcomes

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

- categorize tasks best handled by a microcontroller or DSP.
- analyze software routines of typical digital input and output devices.
- modify and troubleshoot software routines demonstrating digital system operations.
- design interface circuits and modify software routines for input and display devices.
- design circuits and modify microcontroller software routines to interface with sensors and motors.
- create and troubleshoot DSP routines for power supplies and motor control.
- diagnose and correct microcontroller hardware and software problems.

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.

Student Learning Outcomes

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

- demonstrate the programming of a function generator to generate basic electronic communication signals and use an oscilloscope for measuring and analyzing signals.
- program a software defined radio (SDR) to tune in radio frequency (RF) signals and display the frequency spectrum.
- create and display digital communication signals using an arbitrary function generator.
- organize blocks describing FM transmitters and receivers.
- differentiate RF and microwave frequencies, wavelengths, feedline characteristics, and safety precautions.
- differentiate broadcast and broadband communication.
- describe and measure the radiation patterns for different types of antennas.
- describe P25 digital radio characteristics and the benefits over analog two-way radios.

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.

Student Learning Outcomes

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

- categorize biopotentials and electrodes as they relate to basic human anatomy and physiology systems.
- compare and contrast various temperature and pressure transducers (e.g. ECG electrodes, ultrasound transducers, pressure transducers) that convert physiological properties to electrical signals.
- set up different types biomedical equipment and differentiate their uses for calibration and troubleshooting.
- list and compare the different types of bioelectric amplifiers, signal processing circuits, and isolation circuits.
- distinguish and list various medical imaging technologies.
- identify and describe medical equipment used to measure physical and electrical functions of the heart such as flow rate, pressure, bioelectricity, and electroconduction.
- diagram the leads used in a standard 3-lead, 5-lead, and 12-lead electrocardiogram.
- list the major electrical, chemical, radiation, biological, and fire hazards.
- list the regulatory agencies affecting the biomedical business.
- identify and describe medical equipment used to analyze blood.
- compare and contrast the protocols for working in the operating room and special care units in the hospital.
- identify and describe medical equipment and respiratory transducers used to test the mechanics of breathing and typical parameters of respiration.
- diagnose typical failures of transducers from displayed waveforms.

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.

Student Learning Outcomes

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

- measure grounding and leakage current with an electrical safety analyzer.
- associate the applicable regulation with the regulating organizations.
- diagram the standard leads and set up an electrocardiogram (ECG) simulator to performance test an ECG monitor.
- set up the following equipment: multi-parameter physiological monitor, ECG machine, blood pressure monitor, defibrillator, pulse oximeter, infusion pump, and electrosurgical unit.
- evaluate the data from basic preventive maintenance tests on the following equipment: multi-parameter physiological monitor, ECG machine, blood pressure monitor, defibrillator, pulse oximeter, infusion pump, and electrosurgical unit.
- analyze electrical measurements from specialized testers for electrosurgery and defibrillator equipment.

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.

Student Learning Outcomes

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

- analyze malfunctions in complex electronic equipment.
- describe the functions and operation of various electronic equipment.
- demonstrate skills in fabrication and repair techniques.
- design and construct an electronics project.
- research electronics information and specifications from printed and Internet sources.

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.

ET 499 Experimental Offering in Electronics Technology

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

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