UTAH SYSTEM OF HIGHER EDUCATION

Utah System of Higher Education

Electronics Technology

FY2023 /25 Credits (750 Clock-Hours)

Electronics Technology			
Institutions: Bridgerland, Salt Lake			
Certificate of Program Completion (Catalog Year: 2023, 25 Credits/750 Clock-Hours Required, CIP 47.0105)			
Core (18 Credits/540 Clock-Hours)		**Credits**	**Clock-Hours**
TEET 1030	IPC-A-610 Certification: Acceptability of Electronic Soldering	1	30
TEET 1040	Electronics Assembly and Soldering	1	30
TEET 1060	DC Electronics	4	120
TEET 1070	AC Electronics	4	120
TEET 1080	Analog Electronics	4	120
TEET 1090	Digital Fundamentals	4	120
Electives (7 Credits/210 Clock-Hours)			
Bridgerland Technical College (Complete one Emphasis)			
TEAM 1060	Motor Controls	3	90
TEAM 1070	Programmable Logic Controllers	4	120
TEAM 1110	Introduction to Robotics	2	60
TEET 1100	Microcontrollers I	2	60
TEET 1105	Microcontrollers II	2	60
TEET 1110	Instrumentation	3	90
TEET 1120	Communication Circuits	2	60
TEET 1130	IPC-J-STD-001 Certification: Requirements for Electronic Assemblies	1	30
TEET 1140	IPC-WHMA-A-620 Certification: Cable and Wire Harness Assemblies	1	30
TEET 1150	PCB Design and Fabrication	2	60
TEAM 1120	3D Modeling	2	60
TEET 1160	Electronics Final Project	2	60
TEET 1170	Drone Piloting UAVs	1	30
TEET 1180	Industry Related Certifications/Seminars 30 – 120 hours	1 - 4	30 - 120
TEET 1800	Special Applications 30 – 180 hours	1 - 6	30 - 180
TEET 1900	Electronics Externship	4	180
Salt Lake Community College			
TEET 1110	Instrumentation	3	90
TEET 1190	Troubleshooting	3	90
TEET 1200	Certified Electronics Technician	1	30

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PROGRAM DESCRIPTION

The Electronics Technology program supports a wide variety of electronic systems. This accredited program prepares students with the necessary skills to become technicians in several critical electronic related industries. Students are introduced to a wide variety of tools, instruments, power supplies, signal generators, practices, and procedures. The program uses a competency based hands-on approach, with other teaching methods that will be employed throughout. Internationally recognized IPC certifications are available in this program. This program prepares students to pass a nationally recognized Certified Electronics Technician exam.

Objectives:

- Demonstrate a working knowledge of electronic systems, prototyping, maintenance, and repair techniques.
- Apply system diagnostics and troubleshooting techniques.
- Read, utilize, and design schematics.
- Demonstrate competency in thru-hole and surface mount soldering for electronic assemblies.
- Demonstrate competency in DC and AC circuit concepts, component characteristics, circuit prototyping and testing.
- Demonstrate competency in Analog and Digital circuit concepts, component characteristics, circuit prototyping and testing.
- Implement and properly use a variety of precision electronic measurement tools and procedures.
- Demonstrate a working knowledge of safety practices and procedures.

COURSE DESCRIPTIONS

IPC-A-610 Certification: Acceptability of Electronic Assemblies **1 Credit/30 Clock-Hours**

The IPC-A-610 Certification: Acceptability of Electronic Assemblies course prepares students to obtain their certification. The Acceptability of Electronic Assemblies certification is the industry standard program for quality assurance/visual acceptance of electronic assemblies based on the world's most widely used electronics assembly acceptability standard. Students become Certified IPC Specialist (CIS) with the IPC-A-610 certification: Acceptability of Electronic Assemblies.

Objectives:

- Discuss the purpose, contents, specifications, and terms contained within the IPC-A-610 specification.
- Recognize proper handling, ESD requirements and cleanliness
- Recognize acceptability requirements for discrete wiring assembly.
- Identify acceptable mechanical assembly requirements.
- Identify the requirements for soldering assemblies and recognize the acceptability requirements for high voltage.
- Recognize all criteria related to terminal connections.
- Recognize the requirements for component installation including orientation, mounting, lead forming, damage, wire/lead termination.
- Recognize the requirements for surface mount assemblies.

Electronics Assembly and Soldering **1 Credit/30 Clock-Hours**

In the Electronics Assembly and Soldering course, students develop the ability to solder and desolder connectors, components, and printed circuit boards using industry standards. Topics include component identification, safety practices, soldering, desoldering, anti-static grounding, and surface mount techniques.

Objectives:

- Apply ESD industry safety and handling practices.
- Select the proper hand-tools and materials for an assembly procedure.
- Maintain and utilize soldering equipment.
- Prepare wire for electronic assemblies and complete wire splices.
- Solder wires to various terminals.
- Solder axial-leaded and multi-leaded through-hole components.
- Solder surface-mount components.
- Identify components, hardware, and wires.

DC Electronics **4 Credits/120 Clock-Hours**

The DC Electronics course covers direct current (DC) basics, electrical safety, components, Ohms law and power calculations, electrical measurements, series and parallel circuits, and power supplies. The course is a balance of theory, and hands-on, including measurements, troubleshooting, and circuit construction.

Objectives:

- Recognize and describe electronic circuits, systems, and electrical hazards while practicing basic safety protocols.
- Use the relationships between voltage, resistance, and current to analyze DC circuits with Ohm’s and power law equations.
- Use, test, and select various electronic components as needed to prototype circuits using schematic diagrams.
- Analyze the properties of magnetism.
- Utilize different types of multimeters to perform electronic measurements of voltage, current and resistance.
- Perform series, parallel and series-parallel combination circuits calculations and measurements, analyze circuits for faulty components.
- Analyze voltage divider, bridge, maximum power transfer circuits.
- Apply Kirchhoff's voltage and current laws to analyze complex DC circuits using theorem analyses.

AC Electronics **4 Credits/120 Clock-Hours**

The AC Electronics course covers the principles of alternating current (AC), inductance, capacitance, transformers, RC, RL, RCL principles and circuits. It also covers passive filters, AC calculations and measurements, troubleshooting, and use of oscilloscopes and function generators.

Objectives:

- Apply alternating current fundamentals of voltage, current, resistance and Ohm’s law.
- Apply function generators and oscilloscopes to AC circuits.

- Determine values and measure characteristics of transformers.
- Use schematic diagrams and symbols to prototype AC circuits.
- Explain the use of capacitors and inductors.
- Perform RL and RC series and parallel circuit calculations and measurements including filter and time constant circuits.
- Analyze the characteristics of series and parallel resistive/reactive (RCL) circuits.
- Discuss series and parallel resonance circuits.

Analog Electronics **4 Credits/120 Clock-Hours**

The Analog Electronics course covers semiconductor technology and active devices such as diodes, transistors, thyristors, optoelectronics, and operational amplifiers. Students explore instrumentation operational amplifier circuits, IC characteristics, power supply circuits, regulators, transistor amplifiers, active filters, and oscillators while performing circuit construction and troubleshooting.

Objectives:

- Identify basic diode applications.
- Design, build, and test basic rectifiers and power supplies.
- Design, build, and test transistor bias circuits.
- Use small-signal, power, and FET amplifiers.
- Demonstrate amplifier frequency response and voltage regulators.
- Use thyristors such as SCRs and Triacs.
- Construct and analyze oscillator circuits.
- Design, prototype, and troubleshoot analog operational amplifier circuits.

Digital Fundamentals **4 Credits/120 Clock-Hours**

The Digital Fundamentals course covers digital concepts, safety, and digital systems. It covers common digital numbering systems, Analog to Digital (A/D) and Digital to Analog (D/A) conversion circuits and interfacing techniques. It also covers the basics of truth tables, logic gates, counters, shift registers, sequential and combinational logic circuits. Students learn usage of digital test equipment for prototyping, measuring, and troubleshooting digital circuits.

Objectives:

- Apply digital concepts, logic gates, logic functions, datasheets, and truth tables.
- Apply safety precautions, CMOS devices, and ESD/EOS.
- Apply digital schematics, wiring and block diagrams.
- Apply numbering systems, conversions, Boolean algebra, simplification, and digital coding.
- Apply digital test equipment and measurements.
- Apply sequential and combinational logic circuitry, counters, decoders, and conversion circuits.
- Apply troubleshooting digital circuits and systems.
- Apply programmable logic devices (PLDs).

NON-ALIGNED (ELECTIVE) COURSES
Bridgerland Technical College (Complete One Emphasis)

Motor Controls **3 Credits/90 Clock-Hours**

The Motor Controls course prepares students with a working knowledge and understanding of real-world motor control operations. Students who complete this course are able to proficiently setup and design motor control circuits utilizing schematics. Students in this course identify components and utilize instrumentation to troubleshoot and maintain systems.

Objectives:

- Demonstrate a working knowledge of safety practices and procedures.
- Operate, install, maintain, and design motor control circuits.
- Demonstrate a working knowledge of commonly used components, devices, and tools.
- Demonstrate a working knowledge of various control systems.
- Apply systems diagnostics and troubleshooting of motor control circuits.

Programmable Logic Controllers **4 Credits/120 Clock-Hours**

The Programmable Logic Controllers course teaches students to interface with programmable logic controllers (PLCs). Programmable logic controllers are the brains of all modern automation technology systems. In this course students develop a working knowledge and skill set in the following competencies: ladder logic, programming standards, hardware selection, various inputs and outputs, communication, troubleshooting, setup and installation.

Objectives:

- Demonstrate a working knowledge of safety practices and procedures.
- Operate, install, maintain, and program programmable logic controller systems.
- Demonstrate working knowledge of ladder logic programming.
- Apply motor control logic within a programmable logic controller system.
- Apply timers and event sequencing within a programmable logic controller system.
- Configure inputs and outputs for various applications.
- Apply systems diagnostics and troubleshooting of programmable logic control circuit.

Introduction to Robotics **2 Credits/60 Clock-Hours**

The Introduction to Robotics course is an introduction to industrial robot architecture, arithmetic, programming, and simulation. Emphasis is placed on laboratory experiments dealing with simple robot programming, and program execution. In this project-based course, students are given industry recognized simulation software for lab completion. Students put together a series of projects that they program and test for the instructor's approval. A hands-on experience with real industrial robots is also required.

Objectives:

- Determine the working specifications and architecture of a robot arm.
- Calculate necessary arithmetic, geometry, and trigonometry relative to robot arms.
- Program a robot arm through industry specific simulation software.
- Test and execute robot arm programs in industry recognized simulators.
- Test and execute a robot arm program with industrial robots.

- Identify what types of robots are available for Industrial and servicing applications.

Microcontrollers I **2 Credits/60 Clock-Hours**

The Microcontrollers I course is a study in microcontroller architecture, arithmetic, programming, and interfacing. Emphasis placed on laboratory experiments dealing with microcontroller circuit build, program execution and interfacing. In this project-based course students work with an industry standard platform such as Arduino, Microchip, etc. Students put together a series of projects that they design, build, program, and test for the instructor's approval.

Objectives:

- Design and build microcontroller circuits.
- Program and test microcontroller circuits using structured text.
- Apply peripheral interfacing in software and hardware.
- Use interrupt control.
- Use software development tools.
- Use a C based programming language.

Microcontrollers II **2 Credits/60 Clock-Hours**

The Microcontrollers II course is an advanced study in microcontroller architecture, arithmetic, programming, and interfacing. Emphasis is placed on laboratory experiments dealing with microcontroller circuit building, program execution, and interfacing. This course includes advanced topics and projects such as communication interfaces, I2C bus, SPI bus, interfacing with liquid crystal displays, hardware and timer interrupts, and data logging with SD cards. An integrated final project is required.

Objectives:

- Design and build advanced microcontroller circuits.
- Program and test advanced microcontroller circuits.
- Apply advanced peripheral interfacing in software and hardware.

Instrumentation 3 **Credits/90 Clock-Hours**

The Instrumentation course explores scientific data collection systems used for natural resources, agriculture, industry, land survey and other markets. Students learn about various sensors, measurement devices, data communications, mobile data technology, power devices, regulators, software, and control devices.

Objectives:

- Use data acquisition systems.
- Use sensors to measure a broad array of parameters for environmental, water resource, research, and industrial applications.
- Demonstrate various procedures to perform calibration efficiently and effectively.
- Analyze sensors output electrical signals and transmit to data loggers.
- Connect sensors to data loggers and other devices.
- Examine different physical principles used in measurement sensors.
- Identify and connect capacitive, inductive, and resistive type sensors.
- Perform sensor measurements using various transducers.

Communication Circuits **2 Credits/60 Clock-Hours**

In the Communication Circuits course, students gain knowledge on the fundamentals of analog and digital communication systems. This includes studying essential components such as amplifiers, oscillators, modulation, mixing, transmitters, receivers, and detection methods. Additional topics include transmission lines, antennas, RF propagation, analog integrated circuits, digital signal processing, GPS, spread spectrum, radar, and optical communications. By the end of this course, students are able to design and analyze communication circuits for a range of applications.

Objectives:

- Explain amplitude and angular signal generation and modulation.
- Build and troubleshoot analog and digital communication circuits.
- Build projects demonstrating transmitters, receivers, amplifiers, mixers, modulation, and detection.
- Discuss transmission lines and wave propagation.
- Explain digital signal processing.

IPC-J-STD-001 Certification: Requirements for Soldered Electronic Assemblies
1 Credit/30 Clock-Hours

The IPC-J-STD-001 Certification course is an industry standard program for hand and machine soldering process and material requirements. Students become Certified IPC Specialist (CIS) with the IPC J-STD-001 certification. The course includes hands-on training and concludes with a qualifying examination. With this portable credential, students receive immediate recognition and value throughout the electronics industry.

Objectives:

- Recognize general safety requirements, necessary tools, and effects of electrostatic discharge (ESD).
- Make acceptable wire and terminal assemblies.
- Make acceptable through hole solder connections.
- Make acceptable surface mount solder connections.
- Identify general soldered connection acceptance requirements.
- Identify machine and reflow soldering process requirements.
- Recognize IPC Test methods and related standards.
- Pass the IPC J-STD-001 written and hands-on exams.

IPC-WHMA-A-620 Certification: Cable and Wire Harness Assemblies **1 Credit/30 Clock-Hours**

The IPC-WHMA-A-620 Certification course is an industry standard program for cable and wire harness fabrication and installation. This training familiarizes students with the general requirements of the IPC/WHMA-A-620 Requirements and Acceptance for Cable and Harness Assemblies and concludes with a qualifying examination. Upon successful completion of this training program, participants will be certified as Application Specialists. With this portable credential, students receive immediate recognition and value throughout the electronics industry.

Objectives:

- Perform cable/wire preparation, measuring, and testing of Cable Assemblies.
- Make crimp terminations and insulation displacement connections.
- Make proper soldered terminations and learn about high voltage applications.

- Explain connectorization and Over-Molding/Potting
- Make professional splices, Coaxial/Biaxial Cable Assemblies, and learn about Ultrasonic Welding.
- Discuss the importance of marking/labeling, wire bundle securing, shielding, and protective coverings.
- Complete common cable assemblies with correct terminations.

PCB Design and Fabrication **2 Credits/60 Clock-Hours**

The PCB Design and Fabrication course is an introduction to PCB (Printed Circuit Board) design, schematic capture, layout, and fabrication. Students are taught how to prepare the CAD layout artwork while generating necessary files to run a CNC PCB mill in-house and to send to a 3rd party vendor to fabricate a PCB. This course culminates with a final project where a board is fabricated, stuffed, soldered, and tested.

Objectives:

- Use schematic capture to develop an electronic schematic.
- Show how to use the parts library and how to make parts not found in the library.
- Identify electronic symbols, components, references, and footprints using available libraries.
- Generate a netlist and use it to develop a printed circuit board layout drawing.
- Use design rule checker for signal integrity and proper board layout.
- Generate necessary files to put PCB into production.
- Fabricate a printed circuit board in-house using a CNC PCB router.
- Create Gerber files to send off to a vendor to produce a printed circuit board.

3D Modeling **2 Credits/60 Clock-Hours**

The 3D Modeling course introduces concepts and techniques of 3D, feature-based, parametric modeling using SolidWorks as the modeling tool. Students are taught the SolidWorks user interface, menus, toolbars, and commands used to create 2D sketches, 3D parts and assemblies. The course covers all topics on the CSWA (Certified SolidWorks Associate) exam and practice tests are provided if certification is desired. Students who have completed this course are able to design brackets, tooling, precision fixtures, safety guarding and similar parts to keep existing equipment working and also to make improvements where needed.

Objectives:

- Use the SolidWorks program and user interface.
- Recognize the file formats and document properties used with SolidWorks.
- Customize SolidWorks to fit your needs.
- Manipulate model views and orientation.
- Practice the fundamentals of fully defining 2D sketches and 3D geometry.
- Practice basic and advanced feature creation to build models.
- Practice creating assemblies from modeled components.
- Create 2D drawings from parts and assemblies.

Electronics Final Project 2 **Credits/60 Clock-Hours**

The Electronics Final Project course challenges students to complete a project including design, layout, construction, operation, and debugging while meeting the given specifications and time limitations. This

may include consumer repair projects upon instructor approval. This course can also include instructor aid project hours as assigned by the instructor.

Objectives:

- Develop schematics for all aspects of the project.
- Develop and submit a required parts list to the instructor.
- Develop a project action plan.
- Meet all project specifications.
- Complete the project within the given time.
- Operate and debug the project to proper operating specifications.

Drone Piloting UAVs **1 Credit/30 Clock-Hours**

The Drone Piloting UAVs course is a basic overview of current drone technology and the terminology used in the industry. Students are taught about diverse types of Unmanned Aerial Vehicles (UAV's), and the uses and limitations of each type. Students use a computer simulator to learn the basic flight controls and learn how a drone reacts to pilot inputs. Students learn how to take-off, hover, and fly basic maneuvers through hands-on flight training with a small drone. Students will practice line of sight (LOS) and first-person view (FPV) flying.

Objectives:

- Discuss drone technology and architecture.
- Identify safety precautions and regulations for drone use.
- Recognize the aerodynamics of drone flight.
- Identify various applications for drones.
- Master skills to control and pilot drones.
- Use FPV (First Person Video) in flying drones.

Industry Related Certifications/Seminars **1-4 Credits/30-120 Clock-Hours**

The Industry Related Certifications/Seminars course is for electronics technology related certifications received at seminars, symposiums, or conferences attended beyond the basic certificate program classes listed. Credit is given in 30 hour increments up to a maximum of 120 hours as approved by the program instructor.

Objectives:

- These objectives will be determined on an individual course basis upon instructor approval of the certification course or seminar the student will attend.

Special Applications **1-6 Credits/30-180 Clock-Hours**

The Special Applications course provides students unique or advanced skill development identified as an immediate need in the current occupational industry. Credit is given in 30 hour increments up to a maximum of 180 hours as approved by the program instructor.

Objectives:

- These objectives will be determined on an individual course basis upon instructor approval of the course taken or the skill developed.

Electronics Externship 4 **Credits/180 Clock-Hours**

The Electronics Externship course links students with employers to provide students with a hands-on insight into the manufacturing and/or electronic technician position. Students shadow an experienced technician. and receive personalized feedback. Students work with their instructor to develop an action plan for improvement. Relevant courses must be completed prior to or in concurrence with the externship.

Objectives:

- Work safely, effectively, and efficiently in electronic/electrical installation, troubleshooting, and repairs.
- Work effectively under downtime situations.
- Communicate effectively with management, technicians, and production associates.
- Demonstrate the proper work ethics, teamwork, and personal management skills.

Salt Lake Community College

Instrumentation 3 **Credits/90 Clock-Hours**

The Instrumentation course explores scientific data collection systems used for natural resources, agriculture, industry, land survey and other markets. Students will learn about various sensors, measurement devices, data communications, mobile data technology, power devices, regulators, software, and control devices.

Objectives:

- Use data acquisition systems.
- Use sensors to measure a broad array of parameters for environmental, water resource, research, and industrial applications.
- Demonstrate various procedures to perform calibration efficiently and effectively.
- Analyze sensors output electrical signals and transmit to data loggers.
- Connect sensors to data loggers and other devices.
- Examine different physical principles used in measurement sensors.
- Identify and connect capacitive, inductive, and resistive type sensors.
- Perform sensor measurements using various transducers

Troubleshooting 3 **Credits/90 Clock-Hours**

The Troubleshooting Course covers principles, techniques, and procedures for troubleshooting electronics circuits and equipment. The equipment covered includes power supplies, audio and RF systems, analog, and digital systems. Emphasis is on the use of test equipment.

Objectives:

- Apply troubleshooting and repair techniques to:
  - DC and AC circuits.
  - Various electrical circuits.
  - Discrete solid-state devices and analog circuits.
  - Audio and RF Circuits.
  - Digital circuits.
  - Microcomputer/microcontroller systems.
  - Integrated digital and analog circuits.

- Use various test equipment in troubleshooting.

Certified Electronics Technician **1 Credit/30 Clock-Hours**

The Certified Electronics Technician course prepares students to take the ETA-I Associate Technician Certification exam.

Objectives:

- Demonstrate knowledge of all topics covered in the previous core courses.
- Demonstrate the ability to pass a practice certification exam.
- Pass the actual ISCET or ETA Associate-level Technician exam.