UTAH SYSTEM OF HIGHER EDUCATION

Utah System of Higher Education

The Gateway, Salt Lake City, UT 84101

801-646-4784

Automation Technology — Course Description

Catalog Year: 2024, Required Hours: 630, Credits: 21

Foundational Courses (Required Hours: 630, Credits: 21)

Aligned Courses (Required Hours: 630, Credits: 21)		Credits	Hours
TEAM 1010	**Essential Skills and Safety**	**3.00**	**90.00**

The Essential Skills and Safety course teaches the basic concepts and terminology used in automation technology. Students gain proficiency through applying concepts of fasteners, measurement equipment, tolerances, and hand and power tool operations. The course covers safety and workplace skills as well as school and shop specific operations, standards, and procedures.

Objectives:
- Demonstrate a working knowledge of general safety practices and procedures.
- Demonstrate a working knowledge of hand, power, and measurement tools.
- Demonstrate a working knowledge of hardware and fasteners.
- Apply working knowledge of workplace skills.
- Review school specific orientation, standards, and procedures.

TEAM 1020	**Pneumatics**	**2.00**	**60.00**

The Pneumatics course prepares students with the fundamentals needed to work with pneumatic systems. Pneumatic systems are used in a variety of industries where cleaner, faster, and more cost-effective work needs to be done. Competencies include safety, maintenance, operation, installation, component identification, principles of pressure and flow, air logic, troubleshooting, analysis of performance and efficiency, and design of pneumatic systems.

Objectives:
- Demonstrate a working knowledge of safety practices and procedures of pneumatic systems.
- Operate, install, and maintain pneumatics systems, tools, and devices.
- Read, utilize, and design pneumatic systems schematics.
- Analyze applications and design of pneumatic systems.
- Apply systems diagnostics and troubleshooting of pneumatic circuits.

TEAM 1030	**Hydraulics**	**2.00**	**60.00**

The Hydraulics course prepares students with the fundamentals needed to work with hydraulic systems. Hydraulic systems are used in a variety of industries where extra force may be required. Competencies include safety, maintenance, operation, installation, component identification, displacement principles, troubleshooting, analysis of performance and efficiency, and design of hydraulic systems.

Objectives:
- Demonstrate a working knowledge of safety practices and procedures of hydraulic systems.
- Operate, install, maintain hydraulic systems, tools, and devices.
- Read, utilize, and design hydraulic system schematics.
- Analyze applications and design of hydraulic systems.
- Apply systems diagnostics and troubleshooting of hydraulic circuits.

TEAM 1040	**Industrial Mechanics**	**3.00**	**90.00**

The Industrial Mechanics course is designed to introduce students to the world of mechanical drive systems and their characteristics. Students can demonstrate competency in the following: couplers, component identification, system related calculations, alignment, the effects of wear and vibration, component failure detection and prevention.

Objectives:
- Demonstrate a working knowledge of safety practices and procedures.
- Maintain, calibrate, and repair power transmission systems.
- Maintain, calibrate, analyze, and repair mechanical drives (v-belt, chain, gear drive).
- Use and apply vibration and alignment measurement instrumentation and techniques.
- Troubleshoot mechanical drive components and systems.

TEAM 1050	**Electrical Systems**	**2.00**	**60.00**

The Electrical Systems course teaches students to troubleshoot most electrical circuits they encounter in everyday life. Our world runs on electrical power and is fundamental to all work being done in automation. Students in this course gain relevant working knowledge in both AC & DC electrical systems. Competencies include basic electrical circuit design, analysis, troubleshooting, instrumentation, schematic and component identification, physics of electricity and applicable math.

Objectives:
- Demonstrate a working knowledge of safety practices and procedures of basic electrical systems.
- Operate, install, maintain electrical systems, tools, and devices.
- Read, utilize, and design electrical systems schematics.
- Apply principles and applications of electrical AC and DC systems.
- Apply systems diagnostics and troubleshooting of electrical circuits.

TEAM 1060	**Motor Controls**	**3.00**	**90.00**

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.

TEAM 1070	**Programmable Logic Controllers**	**4.00**	**120.00**

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.

TEAM 1080	**Applied System Diagnostics**	**2.00**	**60.00**

The Applied System Diagnostics course covers the essentials of system diagnostics, the essence of what a technician does day to day. This course is designed to simulate real world troubleshooting scenarios. Students apply troubleshooting methodology by using all of the skills that they have learned so far in the program. Students are expected to properly diagnose, repair, and document their work on a variety of systems and challenges.

Objectives:
• Demonstrate a working knowledge of safety practices and procedures.
• Troubleshoot an entire system using pre-defined schematics.
• Complete standard technician documentation.
• Use troubleshooting instrumentation within multiple systems.

Supplemental Courses Varies by Institution (Required Hours: 0, Credits: 0)

Bridgerland Courses (Required Hours: 270, Credits: 9)

		Credits	Hours
TEAM 1100	**Electric Motors and Drives**	**1.00**	**30.00**

The Electric Motors and Drives course covers the identification of the operating characteristics and nameplate information of most types of electric motors. Students evaluate the operation of AC motors and DC Motors such as the series, shunt, and compound motors. Students use a mega-ohm-meter (meggar) to troubleshoot and test motor windings. This course introduces students to electric motor drives; they will install and program an electric motor drive for motor speed control, including ramp-up and ramp -down parameters. Students learn how three-phase alternating current (AC) is generated in Delta or Wye circuits. Lab work will reinforce the theory.

Objectives:
• Recognize various types of electric motors.
• Use the nameplate information on a motor for troubleshooting.
• Wire single and three-phase motors.
• Identify the operating characteristics, nameplate information, and troubleshooting procedures for single-phase motors, generators, AC/DC motors, control transformers, distribution systems, and Delta and Wye transformer configurations.
• Identify the operating characteristics, nameplate information, and troubleshooting procedures for three-phase motors – Delta or Wye connected 9 or 12 lead motors.
• Install and troubleshoot electric motor drives.
• Perform a complete motor control panel build and wiring exercise from a schematic.
• Use schematic drawings and test equipment to isolate problems in basic electric motor circuits.
• Follow a step-by-step troubleshooting process to solve problems within an integrated system.

TEAM 1110	**Introduction to Industrial Robotics**	**2.00**	**60.00**

In the Introduction to Industrial Robotics course, students are introduced 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. 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.

TEAM 1120	**3D Modeling**	**2.00**	**60.00**

In the 3D Modeling course, students learn concepts and techniques of 3D, feature-based, parametric modeling using SolidWorks as the modeling tool. Students learn the SolidWorks user interface, menus, toolbars, and commands used to create 2D sketches, 3D parts and assemblies. Learn how to build design intent into models with the use of relations, dimensions, and assembly mates. All concepts covered on the CSWA (Certified SolidWorks Associate) exam are taught. This course covers enough material to allow maintenance technicians 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 users' needs.
- Manipulate model views and orientation.
- Practice the fundamentals of fully defining 2D sketches and 3D geometry.
- Perform basic and advanced feature creation to build models.
- Create assemblies from modeled components.
- Create 2D drawings from parts and assemblies.

TEAM 1125	**Solidworks CSWA Certification**	**1.00**	**30.00**

The Solidworks CSWA Certification course is designed to help students who have already completed the 3D Modeling course prepare to pass the CSWA Solidworks certification test.

Objectives:
- Prepare to take the CSWA Solidworks exam by completing practice tests.
- Review common Solidworks tasks and problems.

TEAM 1700	**Introduction to Studio 5000**	**1.00**	**30.00**

The Introduction to Studio 5000 course introduces students to Rockwell Software's Studio 5000 and a CompactLogix processor. Students learn networking, connection to a PLC using RSLinx, Studio 5000 tags, and addressing IO. Students perform various labs intended to increase familiarity and competency in the Studio 5000 and CompactLogix environments.

Objectives:
- Describe an ethernet network.
- Connect the RSLinx to a PLC via an ethernet network.
- Use tags in Studio 5000.
- Edit a PLC program using Studio 5000.
- Program several tasks using a CompactLogix PLC and Studio 5000.

TEAM 1200	**HVAC Refrigeration**	**3.00**	**90.00**

In the HVAC Refrigeration course, students learn HVAC-R plus components and the principles of heating and air conditioning. Basic refrigeration systems and applications will be introduced, and preparation for the EPA 608 certification for refrigerant gases will be completed.

Objectives:
- Demonstrate knowledge of HVAC safety practices and procedures.
- Measure head pressure in a tube
- Heat and cool a room using a standard heat pump-based HVAC system.
- Set up and properly adjust a furnace system.
- Apply systems diagnostics and troubleshooting of HVAC systems.

TEAM 1300	**Building Control Panels**	**3.00**	**90.00**

In the Building Control Panels course, students will learn about control panel assembly, standards, skills, and practice. Industrial Control Panel standards are utilized, and special panel building tools are taught.

Objectives:
- Demonstrate knowledge of common control panel safety practices and procedures.
- Create a plan for a panel build project including electrical conduit capacity calculations, enclosure size, wire number and size, component placement.
- Demonstrate ability to correctly read and mark wiring prints.
- Demonstrate proper component layout and organization.
- Modify panel enclosures.
- Demonstrate proper wiring standards in regards to size, type, and color.
- Layout, mount, and wire a complete Control Panel while implementing UL508A standards.

TEAM 1005	**Computer Tools for Technology**	**1.00**	**30.00**

In the Computer Tools for Technology course, students learn common software and systems used by technicians. This course provides a fundamental understanding of computing including knowledge and use of computer hardware, software, operating systems, networking, and router security. The course covers basic use and common features of applications including internet use, e-mail, spreadsheets, and Google drive applications.

Objectives:
• Identify computing fundamentals such as computer hardware, software, and operating systems.
• Navigate the Windows environment.
• Demonstrate the use of spreadsheets.
• Demonstrate the use of Google applications.
• Demonstrate the use of pdf files.
• Achieve proficient typing speed.

TEAM 1003	**Spreadsheets for Automation**	**2.00**	**60.00**

In the Spreadsheets for Automation course, students learn spreadsheet functions and applications commonly used in industrial processes and quality control. Students learn how to design, create, manipulate, calculate, and present data. Students apply spreadsheet techniques in developing formulas and applications for industrial settings.

Objectives:
• Input and format data.
• Insert formulas and functions in worksheets.
• Name and utilize range names in formulas.
• Create equations using relative and absolute cell references.
• Create conditional statements using formulas.
• Use match and index functions.
• Apply power functions.
• Correctly apply math functions.
• Correctly apply date and time functions.
• Correctly apply reference functions.

TEAM 1400	**GD&T Blueprint Reading**	**2.00**	**60.00**

In the GD&T Blueprint Reading course, students learn advanced principles and techniques of production drawings such as geometric dimensioning and\or tolerancing, assembly and production dimensioning, general tolerancing, symbols and terms, geometric characteristics, classes of fit, surface quality, and production specifications.

Objectives:
• Identify various GD&T symbols and terms used in production drawings.
• Produce general tolerancing to produced drawings.
• Produce feature control frames and properly place on drawings.
• Produce drawings with proper GD&T symbols attached.

TEAM 1450	**Introduction to Quality**	**2.00**	**60.00**

In the Introduction to Quality course, students learn the concepts underlying quality control and develop their ability to apply those concepts to the design and management of quality control processes in industries. Major topics include the tools for descriptive and predictive statistical analysis, design and use of various control charts for quality control, process characterization and capability analysis, R&R gauge capability studies, design of experiments, acceptance sampling and continuous improvement. The emphasis will be on ensuring that the students gain both a broad perspective of quality control as well as the technical skills necessary to implement quality control in any industrial setting.

Objectives:
• Analyze data required for process/line verification.
• Apply calibration principles in measuring and instrumentation tools.
• Run and evaluate Measurement System Analysis (MSA).
• Apply principles of Advanced Product Quality Planning (APQP).
• Read and understand a PFMEA and control plan.
• Write work instructions and visual inspection guides.

TEAM 1500	**Instrumentation Process Control**	**3.00**	**90.00**

In the Instrumentation Process Control course students are introduced to the concepts and terminology of Instrumentation-Process Control using theory and a hands-on approach used in refineries, water treatment plants, boilers, HVAC, refrigeration systems, and many other temperature, pressure, level, flow, analysis, transmission and communication, and automatic control applications.

Objectives:
• Demonstrate knowledge of safety practices and procedures.
• Demonstrate the ability to set up multiple process control sensors.
• Demonstrate ability to manually and automatically adjust valves.
• Wire and actuate a valve positioner and solenoid valve.
• Setup common components such as control valves, regulators, dampers, actuators, positioners, solenoid valves, and variable frequency drives within a standard system.
• Calibrate and install temperature, pressure, level, and flow instruments.
• Use troubleshooting instrumentation competently within multiple systems.

TEAM 1900	**Automated Technology Externship**	**4.00**	**180.00**

The Automated Manufacturing Externship course is a practical approach to acquiring new competencies and skills needed for a job in a real working environment that are either difficult to gain in a classroom setting or specific to certain employers. Students learn how to use particular tools or equipment specific to an employer in a live-work practice environment. Students learn workplace expectations, equipment operation, and any other skill they need to enhance their current skill sets and become more valuable to their employer. A supervisor and the student initially set objectives, experiences, and competencies that are also approved by the supervising institutional instructor. The supervisor evaluates and reports the student's strengths and weaknesses upon completion of the training. Instructors meet with students to review the evaluation reports.

Objectives:
• Apply the knowledge and skills attained in the program of study to real-world work experience.
• Work safely, effectively, and efficiently in installing, troubleshooting, and repairing the following systems: pneumatics, hydraulics, electric motors, electric motor controls, electronic, programmable logic controllers, mechanical applications, and blueprint reading.
• Work effectively in downtime situations.
• Communicate effectively with management, technicians, and production associates.
• Demonstrate proper work ethics, teamwork, and personal management skills.

TEET 1040	**Electronics Assembly and Soldering**	**1.00**	**30.00**

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.

TEET 1060	**DC Electronics**	**4.00**	**120.00**

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.

TEET 1070	**AC Electronics**	**4.00**	**120.00**

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.

TEET 1100	**Microcontrollers I**	**2.00**	**60.00**

The Microconrollers I 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 will be given a platform to work with from several available on the market such as Arduino, Microchip, or others. Students will 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.

TEET 1105	**Microcontrollers II**	**2.00**	**60.00**

The Microcontroller II course is an advanced study in microcontroller architecture, arithmetic, programming, and interfacing. Emphasis placed on laboratory experiments dealing with microcontroller circuit build, 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.

TEMT 1005	**Machining for Manufacturing Trades**	**3.00**	**90.00**

This is a course to support manufacturing programs related to machining. It gives students a working overview of industrial machine shop practice. This course is designed to teach principles and techniques of manufacturing processes by learning to operate the lathe and mill. Students will be trained in areas of blueprint reading, hand tools, machining and part inspection, all with the use of manual machines.

Objectives:
- Identify safe practices in a machine shop.
- Identify correct clean up procedures.
- Demonstrate basic layout procedures.
- Reading and interpreting blueprints.
- Safely setup and operate a band saw.
- Safely operate a bench grinder and hand tools.
- Accurately use and read steel rules, micrometers, and calipers.
- Perform safe and effective use of lathes and milling machines.
- Perform basic programming and use controls of a CNC machine.

TEWT 1005	**Welding Overview**	**3.00**	**90.00**

This course is designed to provide students with the basic knowledge and experience to perform oxyacetylene welding, brazing, and cutting. It will teach fundamentals in a Shielded Metal Arc and Gas Metal Arc Welding. Gas Tungsten Arc Welding will also be introduced. Students will learn to run beads, groove, and fillet welds in butt, tee, and lap joints.

Objectives:
- Setup welding equipment.
- Perform safety inspections of equipment and accessories.
- Light torch and demonstrate oxidizing, neutral, and carborizing flames.
- Weld butt, lap, and tee joints in flat position oxyacetylene.
- Braze weld butt, lap, and tee joints.
- Weld butt, lap, and tee joints with arc welding processes.

TEWT 1105	**Welding Qualifications**	**3.00**	**90.00**

This advanced welding course teaches students to set up, weld, and test selected welder qualification plates. Weld qualifications can be earned in the Gas Metal Arc, and Shielded Metal Arc Processes. All welding will comply with the AWS D1.1 Structural Welding Code – Steel.

Objectives:
- Set up the welder correctly for each welding process.
- Prepare qualification plates according to code standards.
- Weld qualification plates in various positions with Shielded Metal Arc Welding.
- Weld qualification plates in various positions with Gas Metal Arc Welding.
- Prepare test plates properly for face and root bends.

Davis (Required Hours: 270, Credits: 9)	Credits	Hours

TEAM 1015	**Electronic Fundamentals for Industrial Automation**	**4.00**	**120.00**

This course introduces students to the concepts and fundamentals of electronic devices, systems, and circuits. Students will learn the basics of DC/AC circuits; semiconductor and analog circuits; and microcomputers and learn how to use meters, oscilloscopes, and other measuring equipment. Students will also learn the skills required to make algebra calculations in an automation shop environment.

Objectives:
- Demonstrate knowledge of basic functionality of DC/AC circuits.
- Apply knowledge of basic components of semiconductor/analog circuits.
- Demonstrate knowledge of the basic purpose of digital gates, circuits, and systems.
- Use meters, oscilloscopes, and other measuring equipment.
- Perform US to metric conversions.
- Calculate surface and square measurements.
- Work with rational and real numbers.
- Add, Subtract, Multiply, and divide integers.
- Solve shop algebra calculation.

TEAM 1800	**Renewable Energy**	**2.00**	**60.00**

Students in this course will learn about alternative and sustainable energy sources. Students will conduct cost-benefit analysis on each form of alternative energy in order to determine what is practical on a large or small scale. Students will cover the efficiencies of each alternative energy source as well as what limitations exist in terms of extracting usable energy. Students will also learn how a fuel cell works and how they can power automobiles.

Objectives:
- Practice electrical safety and identify the effects electricity can have on the human body.
- Analyze energy production and consumption.
- Compare different energy sources.
- Describe how solar thermal energy sources operate.
- Explain solar and wind basics.
- Perform an analysis of incentives and costs.
- Explain fuel cell operation.
- Compare career opportunities.
- List non-renewable energy sources.
- Explain what resources are available through the National Renewable Energy Laboratory.
- Describe positive and negative ions.
- Describe how voltage, resistance, and current are related to each other.
- Read, draw, and identify electrical schematic systems.
- List the types of solar energy.
- Perform solar and wind installations.

TEAM 1810	**Lean Manufacturing (Six Sigma)**	**1.00**	**30.00**

In this course students will study lean manufacturing, ISO 9000 overview, manufacturing maintenance strategies, continuous process improvement, process design development, supply chain management, total productive maintenance, Five S overview, cellular manufacturing, and intro to six sigma, troubleshooting processes, and kaizen events. This includes discussions of the seven forms of waste and describing the role of a Quality Management System. Students will demonstrate the implementation of maintenance management strategies including reactive, corrective, predictive, preventive, reliability-centered and total productive maintenance.

Objectives:
- Describe ISO 9000.
- Describe Process analysis and improvement for a Quality Management System.
- Describe factors involved in selecting a maintenance approach.
- Distinguish between reactive, preventive, and predictive maintenance.
- Describe the impact of cost on the troubleshooting process.
- Differentiate between types of facility layouts.
- Explain the rules governing workplace safety.
- Identify the steps involved in 5S.
- Define root cause analysis.
- Distinguish between Six Sigma and lean initiatives.
- Identify the factors that determine cell design.
- Describe the importance of lean metrics.

TEAM 1250	**Plumbing for Automation Technology**	**1.00**	**30.00**

Plumbing for Automation Technology explores how to design, install, and test plumbing systems in commercial settings. Topics covered include safety, tools and materials, common joints and plumbing systems.

Objectives:
- Identify safety issues and concerns with Industrial plumbing and commercial facilities.
- Create piping arrangements, and isometric drawings using symbols for fittings, flanges, valves, and mechanical equipment.
- Identify installation and layout techniques used in engineering.
- Size and install various types of pipes.
- Identify plumbing codes and specifications.

TEAM 1200	**HVAC Refrigeration**	**3.00**	**90.00**

In the HVAC Refrigeration course, students learn HVAC-R plus components and the principles of heating and air conditioning. Basic refrigeration systems and applications will be introduced, and preparation for the EPA 608 certification for refrigerant gases will be completed.

Objectives:
- Demonstrate knowledge of HVAC safety practices and procedures.
- Measure head pressure in a tube
- Heat and cool a room using a standard heat pump-based HVAC system.
- Set up and properly adjust a furnace system.
- Apply systems diagnostics and troubleshooting of HVAC systems.

TEAM 1170	**UAV Drone Technology**	**1.00**	**30.00**

Students in this course will learn cutting edge drone technology, function, assembly, programming, profitable and fun applications, and proper operation. Students will learn through hands-on practice of real-world applications of video, imaging, and mapping. Students will use propeller and fixed-winged simulators and drones to learn to properly operate drone technology. Students will learn to properly utilize FPV (First Person Video) with drones, ground control, connections, programming flight patterns, future of drones, and employment opportunities.

Objectives:
- Identify and apply drone technology and architecture.
- Demonstrate safety precautions and regulations for drone use.
- Build, program, and test a drone.
- Identify applications for drones.
- Apply peripheral sensors, equipment, and interfacing in software and hardware.
- Master skills to control and pilot drones.

TEAM 1820	**Semiconductor Devices**	**4.00**	**120.00**

Semiconductor Devices explores diodes and transistor principles. Throughout this course, you will study semiconductor theory, bipolar, and field effect device characteristics as well as modern thyristor devices. You will also examine the use of diodes in communication circuits and power supply applications, bias transistor circuits, the use of small -signal, power and FET amplifiers and measurement of frequency response to an amplifier.

Objectives:
- Identify the different diodes and their applications.
- Test, install and troubleshoot diodes.
- Identify rectifiers and power supplies.
- Identify the different transistors and their applications.
- Test, install and troubleshoot transistors.
- Identify amplifiers, field effect transistors (FETs), operational amplifiers, and analog oscillators.
- Identify silicon-controlled rectifiers (SCRs), diacs and triacs.
- Draw a complete system, use simulation software, and then construct the circuit on the lab trainer.

TEAM 1300	**Building Control Panels**	**3.00**	**90.00**

In the Building Control Panels course, students will learn about control panel assembly, standards, skills, and practice. Industrial Control Panel standards are utilized, and special panel building tools are taught.

Objectives:
- Demonstrate knowledge of common control panel safety practices and procedures.
- Create a plan for a panel build project including electrical conduit capacity calculations, enclosure size, wire number and size, component placement.
- Demonstrate ability to correctly read and mark wiring prints.
- Demonstrate proper component layout and organization.
- Modify panel enclosures.
- Demonstrate proper wiring standards in regards to size, type, and color.
- Layout, mount, and wire a complete Control Panel while implementing UL508A standards.

TEAM 1500	**Instrumentation Process Control**	**3.00**	**90.00**

In the Instrumentation Process Control course students are introduced to the concepts and terminology of Instrumentation-Process Control using theory and a hands-on approach used in refineries, water treatment plants, boilers, HVAC, refrigeration systems, and many other temperature, pressure, level, flow, analysis, transmission and communication, and automatic control applications.

Objectives:
- Demonstrate knowledge of safety practices and procedures.
- Demonstrate the ability to set up multiple process control sensors.
- Demonstrate ability to manually and automatically adjust valves.
- Wire and actuate a valve positioner and solenoid valve.
- Setup common components such as control valves, regulators, dampers, actuators, positioners, solenoid valves, and variable frequency drives within a standard system.
- Calibrate and install temperature, pressure, level, and flow instruments.
- Use troubleshooting instrumentation competently within multiple systems.

TEAM 1550	**Process Technology Equipment and System Operators**	**3.00**	**90.00**

This course introduces students to the concepts and terminology of Process Technology Equipment and Systems using theory and a hands-on approach used in refineries, water treatment plants, boilers, and many other temperatures, pressure, level, flow, analysis, transmission and communication, and automatic control applications.

Objectives:
- Demonstrate knowledge of the basic functionality of process technology equipment.
- Apply knowledge of basic components of process technology equipment.
- Demonstrate knowledge of the basic purpose of process technology equipment.
- Use meters, and other measuring equipment associated with process technology.

TEAM 1600	**Microcontroller and Microprocessor Programming**	**2.00**	**60.00**

This course is a series of presentations/study in number systems and codes, microprocessor/microcontroller architecture, computer arithmetic, machine and assembler language programming, and microprocessor interfacing. Emphasis is placed on laboratory experiments dealing with machine/assembler language program execution and interfacing using an Arduino starter kit.

Objectives:
- Write assembly code programs.
- Apply peripheral interfacing in software and hardware.
- Utilize interrupt control and software polling.
- Use software development tools.

TEAM 1620	**Electronics Assembly and Soldering**	**2.00**	**60.00**

Electronics Assembly and Soldering offers you an opportunity to develop the ability to solder and desolder connectors, components, and printed circuit boards using industry standards. You will be introduced to topics including component identification, safety practices, soldering, desoldering, anti-static grounding, and surface mount techniques.

Objectives:
- Identify and place components according to a schematic.
- Demonstrate industry safety practices.
- Use standard anti-static grounding.
- Demonstrate through-hole soldering techniques.
- Demonstrate surface mount soldering techniques.

TEAM 1830	**Aerospace Technician**	**2.00**	**60.00**

In this course, students will identify and apply AF requirements of safety, lockout/tagout procedures, basic shop measurement tools, basic blueprint reading, Container Labeling, SDS procedures, and foreign objects damage and prevention for aircraft and aerospace equipment. Students will apply technical data, regulatory standards, theory, and lockout/tagout procedures. This course trains personnel, to include contractors, who perform direct or indirect maintenance actions/operations on aircraft, missiles, support equipment, components, or active taxiways/runways. Personnel such as security forces, fire department, medical and supply organization workers who may travel through aircraft, missile, support equipment, or component repair work centers, to include driving on active taxiways/runways, must also receive this training.
This course will also cover technical data and regulatory standards, theory, types, identification and inspection techniques, prone areas, reporting and documenting procedures, preventative compounds, removal and surface treatment.
This course will explore a list of essential packaging and production controls, review of guidelines describing the proper way to execute GMP records, examine the GMP personal hygiene requirements, clarify the four key product quality attributes, describe the purpose of GMP codes and regulations, and offer explanations of why companies implement GMP.

Objectives:
- Identify proper Occupational Safety and Health Administration's (OSHA) right-to-know standards.
- Classify Safety Data Sheet (SDS) labels, including color, sections, and symbols according to the Globally Harmonized System.
- Identify possible safety hazards in the work environment.
- Demonstrate basic first-aid procedures Identify proper emergency evacuation practices.
- Identify proper OSHA lockout/tag out standards and devices.
- Demonstrate Global Harmonized System Container Labeling Procedures.
- Demonstrate proper use of basic shop precision measuring instruments.
- Demonstrate basic shop blueprint reading.
- Identify Initial foreign object damage awareness.
- Discuss and identify toxic metal awareness Identify good manufacturing practices.
- Track data of product and provide continuous improvements in manufacturing.
- Utilize quality control in manufacturing environment.

TEAM 1910	**Automated Externship**	**2.00**	**90.00**

Students participating in this course have the opportunity to gain valuable work experience in the Automation and Robotics industry while working under the supervision of a plant manager or maintenance technician. This experience will allow the student to observe and get hands-on experience troubleshooting and repairing equipment.

Objectives:
- Demonstrate competency of skills learned in the classroom and lab in a workplace setting.
- Successfully complete required externship hours in an automation and robotics workplace setting.

TEDR 1005	**Interpreting Engineering Drawings**	**1.00**	**30.00**

Students in this course will learn basic blueprint reading skills. Standard industrial practices will be applied to one or more industrial drawings. The following principles and applications will be used: line types, orthographic projection, dimensioning, sectioning, multi-views, and auxiliary views.

Objectives:
- Identify line, lettering, sketching, and title standards used in drafting.
- Identify symbols used on blueprints.
- Calculate missing dimensions on a drawing.
- Identify information necessary for item/part fabrication on a drawing.
- Define terminology and processes related to manufacturing drawings.
- Describe the function of drawings used in manufacturing.

TEMT 1001	**Introduction to Machining**	**2.00**	**60.00**

Machining Introduction defines basic procedures and machining operations encountered in the machine shop. In this course, you will practice machine shop safety, recognize Safety Data Sheets (SDS), use basic measuring tools, recall shop math, select proper speeds and feeds, label common metal identifications, and reproduce basic layout techniques. In this course, you will have the opportunity to operate bench grinders, saws, and drill presses. The course will also introduce lathe and mill set-up and operation.

Objectives:
- Interpret Material Safety Data Sheets (MSDS) and identify safe practices and clean up procedures in a machine shop.
- Demonstrate accurate use and reading of steel rules, micrometers, and calipers.
- Perform basic layout procedures.
- Demonstrate safe setup, operation, and changing of saw blades for both vertical and horizontal band saws.
- Identify common metals used in a machine shop.
- Demonstrate the use of files, deburring tools, hand tools, and work holding devices.
- Demonstrate safe operation of a bench grinder.
- Demonstrate proper feeds and speeds.
- Perform basic hole making.
- Perform basic turning and milling operations.

WKSK 1500	**Job Seeking Skills**	**1.00**	**30.00**

Job Seeking Skills explores how to prepare and successfully apply to potential career opportunities. During this course, you will be presented with essential job-seeking skills needed to find gainful employment.

Objectives:
- Create a professional resume, cover letter and reference sheet.
- Utilize online tools successfully to create an e-portfolio.
- Expand and develop networking skills.
- Utilize online resources effectively to find job openings.
- Demonstrate the ability to fill out job applications in a professional manner.
- Perform successfully in a job interview.
- Demonstrate appropriate follow-up procedures.

TEWT 1008	**Welding for Manufacturing**	**2.00**	**60.00**

Welding for Manufacturing includes the basic knowledge of Gas Metal Arc Welding (GMAW) and Shielded Metal Arc Welding (SMAW). During this course, you will study welding safety, protection, accident prevention, and troubleshooting. You will practice set-up, operation of equipment, positions, executions, and the workmanship needed for a basic weld.

Objectives:
- Describe oxy fuel cutting process terms.
- Demonstrate proper equipment setup, usage, cleaning, and break-down.
- Discuss and conduct safety inspections of equipment and accessories.
- List and describe oxy fuel cutting equipment.
- Perform setup, lighting, and use of oxy fuel cutting equipment.
- Demonstrate various cutting techniques including straight cuts, beveling, and gouging on various base metals.
- Name key terms for GMAW.
- Make GMAW-S (Short Circuit) Fillet Welds the 2F position.
- Make GMAW-S (Short Circuit) Groove Welds in the 2G position.
- Make GMAW-S (Short Circuit) V Groove Welds in the 2G position.
- List key terms for SMAW.
- Perform Fillet welds on mild carbon steel with E7018 welding.
- Perform Groove welds in the Flat (1G) and horizontal (2G) with 7018.

TEAM 1105	**Electric Motors and Drives**	**3.00**	**90.00**

This class covers identification of the operating characteristics and nameplate information of most types of AC/DC motors. This course will introduce students to Electric Motor drives, including the installation and programing of an electric motor drive for motor speed control, including ramp up and ramp down parameters. In addition, students will learn how three-phase alternating current (AC) is generated in Delta or Wye circuits. Students will gain knowledge about the distribution of electrical power in a manufacturing facility, including service feeders, branch circuits, and control circuits.

Objectives:
- Identify the operating characteristics, nameplate information and troubleshooting procedures for:
  - Single-phase motors and generators.
  - AC/DC motors, control transformers, and distribution systems.
  - Delta and Wye transformer configurations.
  - Three-phase motors – Delta or Wye connected, 9 or 12 lead motors.
- Install and Troubleshoot Electric Motors and Drives.

TEAM 1135	**FANUC IR Vision Systems**	**1.00**	**30.00**

FANUC IR Vision Systems covers basic tasks and procedures required for an operator, technician, engineer or programmer to set up, teach, test, and modify FANUC IR Vision Applications.

Objectives:
• View and/or change robot computer parameters to facilitate access to robots' web browser.
• Set up a camera and perform an inspection vision process.
• Master a robot using vision mastering.
• Create user frames necessary for use with vision systems.
• Calibrate a camera and program a FANUC robot to respond to vision results.

TEAM 1137	**Vision System Basics**	**1.00**	**30.00**

Vision System Basics covers the Cognex In-Sight Explorer software and hardware needed to set up a machine vision project. Students will explore the basics of Cognex vision systems and how to set up basic programs, including hardware and accessories, connecting a camera, image acquisition, and digital imagery theory.

Objectives:
• Utilize Cognex vision system hardware and software.
• Create inspection programs using Cognex In-Sight Explorer software.
• Discuss digital imagery theory.

TEAM 2020	**Human Machine Interface Programming**	**3.00**	**90.00**

Students in this course are introduced to programming an operator panel using graphics and Programmable Logic Controllers (PLCs). Students will learn to convert a PLC program into a graphic Human Machine Interface Panel using GE, Siemens, Opto 22, Modicon, Schneider Electric, Crimson (Red Lion), and Allen Bradley software.

Objectives:
• Identify and discuss the basics of HMI programming.
• Identify different types and programming techniques of HMI programming.
• Discuss the need for HMI programming.
• Install and program an HMI screen.
• Demonstrate operation of multiple HMI screens with GE, Siemens, Opto 22, Modicon, Red Lion and Allen Bradley.

TEAM 2000	**Programmable Logic Controllers II**	**3.00**	**90.00**

During this course, students are introduced to advanced programming techniques of Programmable Logic Controllers. This course includes advanced topics of Programmable Logic Controllers not covered in the introductory course such as, process control, data acquisition, computer-controlled processes, variable speed drives, and networking. It may cover various software packages not included in the introductory class such as Allen Bradley 5000 series programming with hands-on labs and other advanced topics as needed to meet employer needs.

Objectives:
• Identify and discuss the basics of HMI programming.
• Identify Programmable Automation Controller principles and practices.
• Apply advanced topics of Programmable Logic Controllers in a lab setting.
• Learn advanced hardware and software principles as they apply to Programmable Logic Controllers.
• Demonstrate programming of advanced Programmable Logic Controllers on RSLogix 5000 software package to meet employer needs.

TEAM 1140	**Industrial Robotics**	**3.00**	**90.00**

In this course, students will learn basic sensing and locomotion principles as they build and control a robotic arm. Students will learn about the different types of robots that are available for industrial and servicing applications program a robotic arm that will be used for selected activities from manual robot control to computer program mode. Students will determine how much current is required to lift different weights, how to measure the degrees of freedom, calculate maximum reach, and use the control panels.

Objectives:
• Determine the working specifications of a robot arm manipulator.
• Compare the robotic trainer to the human hand.
• Measure the degrees of freedom.
• Determine max vertical and horizontal reach.
• Utilize control panels.
• Identify what types of robots are available for Industrial and servicing applications.

TEAM 1710	**Industrial Networking**	**3.00**	**90.00**

Industrial Networking includes a fundamental introduction to computer networking for industrial automation professionals seeking a practical understanding of the use and simple troubleshooting of common Local Area Networks (LANs), Wide Area Networks (WANs), and wireless networks. During this course, you will examine basic professional IT terminology, computer and networking hardware basics, serial communication, and computer networks protocols. You will also explore and evaluate common LAN/WAN devices such as switches, routers, and wireless access points.

Objectives:
• Identify and work with Wide Area Networks (WANs).
• Identify and work with Local Area Networks (LANs).
• Identify and work with Industrial Network Technologies (SCADA, Ethernet/IP, Fieldbus, Profinet, Allen Bradley Data Highway and DH+).
• Configure and set up multiple Industrial Networks using PLC's, HMI's, Industrial Robots, and VFD's.

TEAM 1720	**Controls Integration**	**3.00**	**90.00**

This course brings together the content of many preceding courses and applies that content to the requirements of systems integration. The problems associated with interconnection and interworking of different components will be explored, and typical solutions will be illustrated using conveyors, manufacturing tools, and robotic devices. The course is largely a hands-on experience in an automated manufacturing environment.

Objectives:
- Build Automation Industrial equipment per the application.
- Learn mechanics of installing sensors and actuators in machine.
- Simulating your system with PLC Logics.
- Testing and analyzing feasibility of the project.
- Build and integrate automated equipment.

TEAM 2800	**Final Project**	**1.00**	**30.00**

This course challenges students to complete a machine build project including design, layout, construction, operation, and debugging while meeting the given specifications and time limitations. Students will develop schematics for all aspects of the machine and develop and submit required parts.

Objectives:
- Develop schematics for all aspects of the machine.
- Develop and submit a required parts list to the instructor.
- Develop, meet, and complete a project action plan.
- Operate and debug the machine to proper operating specifications.

Mountainland (Required Hours: 270, Credits: 9)		Credits	Hours
TEAM 1625	**Electronics Soldering**	**1.00**	**30.00**

This soldering course will teach the students a basic skill level of soldering for both surface mount and through-hole technologies. They will also learn basic electrical components using hands-on skills.

Objectives:
- Solder various terminals.
- Install surface mounting components.
- Identify components.

TEAM 1115	**Robotics I**	**1.00**	**30.00**

Robotics I will instruct students in robot safety, economics impacts, hardware, design and coding. Students will also design a robot and program to perform a task. They will discover the various fields and career opportunities in robotics.

Objectives:
- Practice Safety procedures.
- Operate robotic applications.
- Identify robotic components.
- Identify basic electrical operations.
- Program robot to perform a task.

TEAM 1615	**Conduit Bending**	**1.00**	**30.00**

Students will learn the use of conduit in industry. They will learn how to make measurements and various bends without defects. Students will also learn the different types of conduit and various parts used in industry.

Objectives:
- Bend conduit to industry standards.
- Identify types of conduit.
- Perform various bends.
- Read schematic drawings.

TEAM 2300	**Introduction to RF Plasma**	**1.00**	**30.00**

This course is an introduction to plasma and radio frequency (Rf) concepts for students interested in semiconductor careers as well as those who wish to gain an overview of basic plasma theory. Semiconductor focused students will gain basic knowledge to aid in understanding plasma generation and hazard identification. Course material includes plasma definition, properties, ionization, and generation. Rf material includes basic definition, loss and gain, skin effect, reflection, transmission, inductive coupling, filtering, and leakage.

Objectives:
- Define plasma and identify properties.
- Explain plasma generation.
- Explain radio frequency (RF) concepts as they apply to plasma.
- Define frequency, impedance, power loss.
- Identify hazards possible with use of RF plasma.
- Define Optical Emission Spectroscopy (OES) and explain how it is used to monitor the plasma.

TEAM 1590	**Introduction to Statistical Process Control**	**1.00**	**30.00**

Statistical Process Control is an introduction to statistical process control (SPC) for students interested in semiconductor careers, as well as those who wish to gain an overview of basic SPC practices. Semiconductor focused students will gain basic knowledge to maintain control of critical manufacturing processes. Course material includes overview and benefit, common cause vs. special cause variation, distributions and histograms, basic statistics, process capability, standard deviation, sigma, and control chart basics.

Objectives:
• Define and use basic statistics such as mean, median, standard deviation, normal (bell curve) vs. skewed distributions.
• Identify difference between control and spec limits.
• Process capability.

TEAM 1840	**Introduction to Semiconductor Manufacturing**	**2.00**	**60.00**

Introduction to Semiconductor Manufacturing is a course for students interested in semiconductor careers, as well as those who wish to gain an overview of basic semiconductor processing. Semiconductor focused students will gain basic knowledge of overall process flow and logic gate device functionality. Course material includes definition of a semiconductor, n-type and p-type doping, geometries and units of measure, basic semiconductor manufacturing, process module overviews, clean room overview and protocols, and automated material handling system (AMHS) overview.

Objectives:
• Identify semiconductor basics.
• Define N-type, P-type doping, PN junction.
• Identify MOSFET/CMOS structure and logic gate function.

TEAM 1630	**Sensors and Timers**	**1.00**	**30.00**

Students will identify the use and purpose of inductive, capacitive, and photoelectric sensors. They will learn how to design and read schematics, and to troubleshoot designs using troubleshooting methods.

Objectives:
• Connect and operate inductive sensors.
• Connect and operate capacitive sensors.
• Connect and operate photo electric sensors.

TEAM 1670	**Wiring Boards**	**1.00**	**30.00**

Students will identify the design and wiring of industry standard control panels. They will use wiring organization to make a clean and professional control panel, using the various tools designed for this application.

Objectives:
• Troubleshoot and design circuits.
• Access and use wiring code.
• Connect and operate low voltage/high voltage.
• Use crimps, strippers, wire pullers, and various connections.

TEAM 1112	**Rotating Machines**	**2.00**	**60.00**

Students will learn the different types of motors that are used in industry and also the reasons why certain motors are used for different conditions. They will also learn how they are wired internally and externally. Students will also perform different measurements and do calculations to see how the motors perform under different loads.

Objectives:
• Connect and operate different industrial motors.
• Measure and calculate speed/torque.
• Calculate efficiency and power consumption.
• Graphing motors performance.

TEAM 2030	**HMI and PLC Troubleshooting**	**3.00**	**90.00**

Students will use and design basic Human-Machine Interface (HMI) programs, using Allen Bradly's "FactoryTalk". They will learn how to make the connections between the Programmable Logic Controllers (PLC) and HMI programs. They will also learn to navigate and use alarms. Students will read and troubleshoot PLC circuits, using basic troubleshooting techniques. They will use symptoms to diagnose troubles. They will also learn how to use multimeters to verify the working contrition of different components.

Objectives:
• Identify Factory Talk components.
• Configure communications.
• Create different control navigations.
• Create messages, alarms, and configure diagnostics.
• Identify PLC status indicators.
• Test and troubleshoot discrete input/outputs.
• Troubleshoot PLC faults.
• Test and troubleshoot Analog inputs/outputs.

TEAM 1130	**FANUC Robots**	**1.00**	**30.00**

Students will operate and design basic programs for Fanuc robots. This will get them the basics that are needed to become a Fanuc robot operator and teach them how to operate a robot safely.

Objectives:
• Identify Factory Talk components.
• Configure communications.
• Create different control navigations.
• Create messages, alarms, and configure diagnostics.
• Identify PLC status indicators.
• Test and troubleshoot discrete input/outputs.
• Troubleshoot PLC faults.
• Test and troubleshoot Analog inputs/outputs.

TEAM 2145	**Electro-Fluid Power**	**1.00**	**30.00**

Students will combine electrical controls with hydraulic and pneumatic circuits. They will read, design, and troubleshoot circuits that are using a wide range of devices used in industry.

Objectives:
• Read electric, hydraulic, and pneumatic schematics.
• Connect and operate a variety of industrial relay control systems.
• Design combination circuits.
• Troubleshoot circuits.

TEAM 1240	**Welding Simulator**	**1.00**	**30.00**

Students will gain an understanding of the history of welding. As they study the basics of welding, they will learn to safely operate a welder, using the correct settings. They will focus on the correct techniques for Metal Inert Gas (MIG) welding.

Objectives:
• Identify important historical facts about welding.
• Identify safety protocols.
• Operate a welder using correct settings for various types of metal.
• Weld using correct techniques.

TEAM 1122	**SolidWorks**	**1.00**	**30.00**

SolidWorks is a solid modeling, computer-aided design (CAD) software that is used widely in industry for 3d design. Students will use SolidWorks to design parts and assemble multiple parts into one object. They will also learn how to turn their designs into a drawing.

Objectives:
• Identify components of SolidWorks and navigate software.
• Design parts and assemblies.
• Turn designs into drawings.

TEAM 1815	**Lean and Six Sigma**	**1.00**	**30.00**

Six Sigma is a team-focused managerial approach that seeks to improve performance by eliminating resource waste and defects. In this course, students will learn Six Sigma methods and tools, combined with the Lean Manufacturing philosophy, which strives to eliminate the waste of physical resources, time, effort, and talent while assuring quality in production and organizational processes.

Objectives:
• Identify resource uses that don't create value for the end customer.
• Determine how to eliminate wasted resources or process/product defects.
• Identify non-value-adding activities to remove from production processes.

TEAM 1730	**Basic VFD Operation**	**1.00**	**30.00**

In this course students will learn how to wire a Variable Frequency Drive (VFD) for basic operation. They will also learn how to set the VFD's settings, using both 1 phase and 3 phase applications.

Objectives:
• Identify VFD specs and correct application.
• Wire VFD for single and 3 phase applications.
• Set VFD settings.

TEAM 1045	**Mechanical Drives and Laser Alignment**	**2.00**	**60.00**

This course is a continuation of the industrial mechanics course where students will learn more advanced bearings, gaskets, seals, gear drives, and laser alignments. Students will demonstrate their working knowledge and ability to perform troubleshooting, along with demonstrating attention to safety practices.

Objectives:
- Demonstrate a working knowledge of safety practices and procedures.
- Perform plain bearing selection, maintenance, and troubleshooting.
- Identify roller bearings for specific applications.
- Perform seal maintenance and selection.
- Perform gear lubrication, maintenance, and troubleshooting.
- Operate laser shaft alignment systems.

Ogden-Weber (Required Hours: 270, Credits: 9)		Credits	Hours
TEAM 1650	**Advanced Electrical Systems**	**3.00**	**90.00**

The Advanced Electrical Systems course discusses advanced principles of 3-phase AC systems. Using theoretical and measured values, calculations of values in resistive, inductive, and capacitive circuits are performed. This course demonstrates cause and effect using control transformers, capacitors, and resistive loads in a control circuit.

Objectives:
- Demonstrate wiring of a 3-phase AC circuit using control transformers.
- Demonstrate the use of a DMM to measure current and voltage in complex circuits.
- Demonstrate calculations of capacitance, reactance, and impedance.
- Apply measured values to calculate farad and henry in a circuit.

TEAM 1660	**Advanced Motor Controls**	**3.00**	**90.00**

The Advanced Motor Controls course covers electrical wiring skills like installing control wiring in an electrical panel; installing wiring into limit switches, solenoids, and pressure switches; wiring 3-phase motors, and understanding the importance of correct wire size, material, and insulation.

Objectives:
- Demonstrate electrical control wiring using electrical prints.
- Apply wire management skills based on conductor size, color coding, numbering, and bundling.
- Demonstrate proper termination of motor contacts, overloads, control relays, and disconnects.
- Demonstrate wiring of pneumatics controls circuits and electro-pneumatic valves.
- Demonstrate wiring and communication of VFDs, PLCs, and HMIs.

TEAM 1145	**Industrial Robotics**	**3.00**	**90.00**

The Industrial Robotics course introduces the necessary entry-level robotics technician skills for Fanuc and collaborative robots. The course covers robot anatomy, motion control, safety, tool operations, setup and programming, motion instructions, and working frames. Branching, macros, program creation and editing, input/output signaling, and robot systems are identified along with safe working habits in an industrial setting.

Objectives:
- Demonstrate proper robot safety.
- Describe the anatomy, motion control, safety, and tool operations of robot systems.
- Describe teach pendant.
- Setup robot working frames and motion instructions.
- Create and edit programs.
- Explain branching and macros.
- Define input/output signaling.

Salt Lake (Required Hours: 270, Credits: 9)		Credits	Hours
TEAM 2010	**Programmable Logic Controllers II**	**4.00**	**120.00**

This course covers the usage of industry PLC hardware and software, such as Allen Bradley, covering the programming, setup and connection, operation, editing, for PLC motor control and other applications. This course will also cover programming using ladder logic, PLC instruction set, PLC Timers, Counter, Math, Program Control Instructions, Analog/Digital inputs and outputs.

Objectives:
- Create a PLC program using industry software such as Allen Bradley Studio 5000 software.
- Identify and explain the functions, and advantages of a programmable controller and its components.
- Identify industrial networks used for data communications and explain their function and operation. and type of network sed for data communications.
- Connect and configure PLC controllers for communications using PLC software.
- Use PLC programming software to open and download a program and monitor the status of a controller.
- Identify and explain PLC programming languages, program operation, and PLC memory organization.
- Explain the elements of project creation and organization, programming software, program analysis, and program documentation.
- Identify PLC motor control basics, seal-in program logic, data types and user-defined tags, interlock functions, and PLC discrete control of variable speed drives.
- Explain instructions for PLC timers and counters, non-retentive/retentive timers, time-driven sequencing, and counters.
- Demonstrate the use of event sequencing and continuous cycle logic, modes of operation, stop functions, and on/off process controls.
- Appropriately follow program control instructions, master control reset, subroutines, and jump and label instructions.
- Utilize math and data move instructions.
- Effectively use analog inputs and outputs, configuration, operation, scaling functions, comparison instructions and on/off control.
- Demonstrate the use of variable output applications, PWM temperature control, stepper motors, and absolute and relative modes.

TEAM 2025	**HMI Programming**	**2.00**	**60.00**

This course covers HMI panels, covering the programming, setup and connection, operation, editing, for basic terminal operation/human machine interface (HMI). The course will use and introduce industry hardware and software.

Objectives:
- Operate an HMI Panel Terminal, configure the IP Address, transfer an application using industry software.
- Use HMI application software to edit and create application displays and input and output objects.
- Explore HMI application editing, to include numeric input/output, displays, local messages, alarms, diagnostic messages, and information messages.
- Create a PLC program to support HMI applications.

TEAM 2040	**PLC Troubleshooting**	**2.00**	**60.00**

This course covers the Allen Bradley Compact Logix, PLC troubleshooting, identifying types of PLC faults, use of PLC diagnostics indicators, troubleshooting PLC power supplies, how to test and troubleshoot discrete input/out devices.

Objectives:
- Demonstrate PLC troubleshooting skills and techniques.
- Utilize PLC's status and diagnostic Indicators to determine the status of PLC operation.
- Demonstrate ability to troubleshoot a PLC power distribution system.
- Test discrete input/output devices.
- Use the force function to test a PLC discrete output device.
- Troubleshoot an industry PLC for faults.
- Use a six-step sequence to troubleshoot a PLC system.
- Troubleshoot a continuous cycle reciprocating motor PLC project.
- Troubleshoot a PLC-controlled machine with manual and automatic modes.
- Use the application diagnostics tools to find and replace an instruction.
- Analyze, test, and troubleshoot analog input/outputs.
- Analyze, test, and troubleshoot PWM applications.
- Analyze, test, and troubleshoot variable speed drives PLC applications.
- Analyze, test, and troubleshoot stepper motors PLC applications.

TEAM 2080	**PLC Capstone Project**	**1.00**	**30.00**

This course covers the usage of industry PLC and HMI hardware, as well as software. The capstone will be an industry application project, on the same level as the course lab projects. The course will require the design of a basic PLC project, the setup/wiring of all required PLC hardware and the programming. Documentation and final demonstration of the project will be required.

Objectives:
- Identify correct hardware to support the project.
- Setup and wire power supplies to support the PLC and HMI panel.
- Setup and wire all required input and output devices.
- Create a PLC program using industry software such as Allen Bradley Studio 5000 software.
- Create an HMI program using industry software such as Allen Bradley FactoryTalk View Studio – ME edition.
- Troubleshoot a PLC/HMI system.
- Operate and demonstrate a functioning PLC/HMI industry application system.
- Submit all required project documentation.

TEAM 1520	**Process Control Level/Flow**	**4.00**	**120.00**

This course covers the most common types of process control systems, flow and liquid level. To include process control safety, instrument tags, piping and instrumentation diagrams, troubleshooting and level measurement. System control functions such as liquid level control, automatic control methods, basic flow measurement and control, and control loop performance using industry instrumentation.

Objectives:
- Identify definitions related to process control, safety, the elements of a process control system, and the general requirements of a control system.
- Explain instrument tags, block diagrams, piping and Instrumentation diagrams.
- Demonstrate the use of loop controllers, parameters, and manual operation.
- Use final control operation, I/P operation, and proportional control valves.
- Implement level measurement, level sensor operation, signal measurement, and display scaling.
- Troubleshoot process control systems.
- Utilize liquid level control.
- Implement methods of automatic control.
- Use basic flow measurement and control devices.
- Identify effective control loop performance.
- Use ultrasonic level measurement and control devices.
- Use differential pressure flow measurement and control devices.

TEAM 1580	**Process Capstone Project**	**2.00**	**60.00**

This course will require the identification and use of required hardware to build and setup a functional industry system for flow and level control of fluid such as water. The system must meet the stated criteria for flow/level measurement and control. The system will consist of reservoir tanks and industrial control instrumentation such as PID Controllers, Flow Transmitters, and level sensors.

Objectives:
• Setup, connect and program a basic process automatic level/flow control system.
• Calibrate and use an industrial flow transmitter.
• Setup and use level sensors.
• Use PID controllers for flow and level.
• Operate and demonstrate functioning process flow/level automatic control system.
• Submit all required project documentation.

TEAM 2200	**Troubleshooting Automated Systems**	**3.00**	**90.00**

This course will cover the procedures and techniques for troubleshooting electrical, motor, and control circuits. To include safety, testing and fault determination and component replacement. Efficiency for making a repair will be covered and tracked for time and cost of repair.

Objectives:
• Troubleshoot and repair electrical relay circuits.
• Troubleshoot and repair motor circuits.
• Troubleshoot and repair control circuits.
• Follow safety procedures to avoid injury.
• Troubleshoot and repair common industrial circuits in a timely and efficient manner.

TEAM 1610	**Electric Motor Control Systems**	**4.00**	**120.00**

This course teaches control of three-phase AC electric motors found in industrial applications, starting, reversing, jogging, and motor principles. Coverage of motor selection, diagrams, motor control devices, operation, installation, and troubleshooting. This course includes motor starter circuits, contactors, reduced voltage starting techniques, relays, braking, and variable frequency AC drives.

Objectives:
• Explain requirements for electrical safety in the workplace, protection against electric shock, grounding, and lockout procedures.
• Interpret electrical drawings including various symbols, abbreviations, ladder diagrams, wiring-single line- block diagrams, motor terminal connections, motor nameplate, and terminology.
• Identify motor transformers and distribution systems, power distribution systems, transformer principles, and transformer connections.
• Use various motor control devices including manually operated switches, mechanically operated switches, sensors, and actuators.
• Explain the use and operation of electric motors including motor principles, direct current motors, three-phase alternating current motors, single-phase alternating current motors, alternating current motor drives, motor selection, motor installation, motor maintenance and troubleshooting.
• Connect and operate various contactors and motor starters including magnetic contactors, considering contactor ratings, enclosures, and solid-state types.
• Install various types of relays including electromechanical control relays, solid-state relays, timing relays, latching relays, and relay control logic.
• Connect and operate motor control circuits including motor starting, motor reversing, jogging, motor stopping, and motor speed control devices.
• Follow industry guidelines such as National Electrical Code (NEC) for motor installation.
• Define motor torque and horsepower.
• Explain the operation of variable frequency AC drives and applications in industrial processes.
• Test a control transformer.
• Connect and operate a basic electric control circuit using common Input/output devices.
• Connect and operate basic timer control circuits.
• Troubleshoot motor control systems.

TEAM 1680	**Motor Capstone Project**	**2.00**	**60.00**

This course will require application of concepts learned in the motor course, to include the build and setup of all required hardware for a AC and DC motor control system. Requirements to include performance operation demonstration, safety, seal-in circuits, and forward and reverse operation. The system should comply with industry codes and best practices such as National Electrical Code (NEC).

Objectives:
• Properly setup, wire and operate an AC motor control system.
• Properly setup, wire and operate a DC motor control system.
• Demonstrate correct usage of required hardware/devices.
• Demonstrate wiring techniques to align with NEC.
• Properly setup and wire devices such as switches and lights.
• Submit all required project documentation.

Snow (Required Hours: 270, Credits: 9)	Credits	Hours

TEAM 2100	**Industrial Mechanics II**	**2.00**	**60.00**

The Industrial Mechanics II course teaches linear axis drives, clutches, brakes, piping, fittings, and valves. Students will learn relevant industrial skills including identifying, sizing, selecting, installation, operation, performing analysis, design, troubleshooting and maintenance.

Objectives:
• Select, install, troubleshoot, and maintain the following equipment:
o precision ball screws.
o linear ball bearings.
o linear axis slides.
o matched angular contract bearings.
o cam clutches.
o friction clutches.
o electric brakes.
o flywheels.
• Reference and interpret manufacturer's specification data.

TEAM 2045	**Programmable Logic Controllers Troubleshooting**	**2.00**	**60.00**

The Programmable Logic Controllers Troubleshooting course teaches industry-relevant skills including how to operate, interface, program, and troubleshoot PLC systems for a variety of applications. Students will work with Allen Bradley, RSLogix 5000, and RSLinx, and HMI applications.

Objectives:
• Demonstrate PLC programming, operation, and troubleshooting.
• Explain PLC interfacing.
• Demonstrate PLC program editing.
• Use discrete input/output (I/O).
• Use counters/timer in PLC operation.
• Use BCD/LED in PLC operation.
• Develop program control instructions.

TEAM 2110	**Laser Shaft Alignment**	**2.00**	**60.00**

The Laser Shaft Alignment course teaches how to set up, operate and apply laser shaft alignment to a variety of industrial applications. Topics include laser alignment systems, rough alignment, soft foot correction, alignment analysis and operation.

Objectives:
• Install and troubleshoot laser shaft alignment systems including, rough alignment and soft foot correction.

TEAM 2120	**Vibration Analysis**	**2.00**	**60.00**

The Vibration Analysis course teaches the bearings and gears used in heavy duty mechanical transmission systems. This course will emphasize linear axis drives, clutches, and brakes. In addition, this course teaches how to setup, operate, and apply laser shaft alignment to a variety of industrial applications. Topics include heavy-duty v-belt drives, v-belt selection and maintenance, synchronous belt drives, lubrication concepts, precision shaft alignment, couplings, and heavy-duty chain drives. Students will also learn the basics of vibration analysis used to determine when to perform maintenance of power transmission components.

Objectives:
• Take vibration measurements such as, velocity, acceleration, and spike energy and use these data in conjunction with trend analysis and severity charts to determine problems and their root causes.
• Operate and analyze laser shaft alignment systems including rough alignment, installation, and soft foot correction.
• Use a vibration meter to take a vibration reading, measure shaft misalignment vibration and shaft load imbalance vibration, measure belt drive vibration, interpret a vibration reading, and identify natural frequency.

TEAM 2130	**Industrial Rigging**	**2.00**	**60.00**

This course teaches a comprehensive set of industry-relevant skills including how to safely move loads of different shapes and sizes using a variety of methods. Students will learn skills including hoist operation, installation, maintenance, equipment movement, wire mesh slings, synthetic slings, knots, load turning and cranes.

Objectives:
• Identify appropriate rigging systems.
• Select and maintain the following sling types:
o Wire rope slings.
o Wire mesh slings.
o Chain slings.
o Synthetic Mesh Slings.
o Fiber and Synthetic Rope Slings.
• Install, operate, and maintain:
o block and tackle hoists.
o endless chain hoists.
o electric hoists.
o ratchet hoists.
• Describe spreader beams.
• Calculate sling efficiency.
• Identify, select, and install eyebolts.
• Identify, select, and install hooks.
• Explain load balance.
• Calculate load weight.
• Discuss rigging safety.
• Tie various rigging knots.
• Explain load turning and equipment movement.
• Demonstrate the use of protection pads, pry bars and pry trucks, hydraulic jacks, dollies, and roller bars.
• Demonstrate the use of various types of cranes.

TEAM 2140	**Industrial Hydraulics Troubleshooting**	**3.00**	**90.00**

The Industrial Hydraulics Troubleshooting course introduces industry-relevant hydraulic skills while showing the fundamentals of the hydraulic principles, hydraulic motors, and hydraulic formulas such as calculating theoretical pump flow rate. Students learning skills will include safety, operation, installation, troubleshooting, analysis of performance, and design hydraulic systems. Students will also be skilled in more advanced hydraulics.

Objectives:
• Identify basic hydraulic circuit components and explain their operation.
• Apply principles of Hydraulic Pressure and Flow in the development of hydraulic circuits.
• Complete circuits according to hydraulic schematics.
• Implement hydraulic speed and pressure control devices in circuits.
• Design and maintain hydraulic systems.
• Troubleshoot and repair damaged or faulty hydraulic systems.

TEAM 2150	**Industrial Pumps**	**3.00**	**90.00**

The Industrial Pumps course teaches a comprehensive set of industry-relevant skills including how to operate, install, maintain, troubleshoot, analyze performance, and select centrifugal pumps as well as system design.

Objectives:
• Describe centrifugal pump system operation and characteristics.
• Explain centrifugal pump performance, efficiency, and importance.
• Properly size and select pumps to meet the needs of given scenarios.
• Install and align pumps.
• Describe how to inspect and troubleshoot a centrifugal pump.
• Disassemble and inspect a centrifugal pump with a mechanical seal.

Southwest (Required Hours: 270, Credits: 9)		Credits	Hours
TEAM 2005	**Programmable Logic Controllers II**	**3.00**	**90.00**

In this course, students are introduced to advanced programming techniques of Programmable Logic Controllers such as process control, data acquisition, computer-controlled processes, variable speed drives, and networking. Topics include various software packages not included in the introductory course with hands-on labs and other advanced topics as needed to meet employer needs.

Objectives:
• Identify and describe the basics of HMI programming.
• Identify and apply Programmable Automation Controller principles and practices.
• Apply advanced topics of Programmable Logic Controllers in a lab setting.
• Explain advanced hardware and software principles as they apply to Programmable Logic Controllers.
• Program advanced Programmable Logic Controllers on various software packages to meet employer needs.

TEAM 2210	**Fabrication and Repair**	**3.00**	**90.00**

In this course, students are introduced to proper fabrication and repair techniques of different types of metal, plastic, and other materials, using a variety of machine tools. Topics will also include technical drawings, tolerances, manufacturing fundamentals, tooling selections, and precision measurement practices. Throughout this course students will also perform repairs and replacement of components on commonly used machine tools related to industry.

Objectives:
• Explain, interpret, and design technical drawings using known and unknown specifications.
• Diagnose and troubleshoot commonly used machine tools.
• Understand and apply both basic and advanced uses, and manipulation of commonly used precision measuring instruments to determine if components and parts are within specifications and tolerances.
• Apply competencies to design, construct, and assess a fabrication project to prescribed specifications.

TEAM 1510	**Process Control Components and Systems**	**2.00**	**60.00**

In this course, students are introduced to a wide variety of commonly used process control systems, controllers, Pumps, Valves, and Compressors. This is to include the diagnostics, tear down, repair, and rebuild of commonly used pump types and compressors. Students will learn about various types of valves, controllers, and their application, diagnostics, and repair procedures.

Objectives:
• Identify and diagnose control systems, components, and circuits.
• Identify, use, diagnose, and repair commonly used pumps and compressors.
• Design, use, control and program advanced process controllers and systems.

TEAM 1640	**Electrical Systems II**	**1.00**	**30.00**

In this course, students will study and master the wiring and use of real-world components such as a 3-phase motor, pushbuttons, switches, valves, and the use of a 24VDC control power supply. Students will use these components to study electrical control system wiring, pneumatic control circuit wiring, conductors, disconnects, and overcurrent protection and related applications. The combination of industrial components, and comprehensive curriculum will reinforce electrical wiring concepts and skills to build up the students' confidence and competence.

Objectives:
• Install control wiring in an electrical panel to control and manipulate commonly used components and motors.
• Understand, identify, and calculate the proper wire size, materials, and insulation required for different circuits, applications, and panel requirements.
• Install, wire, and monitor different types of control components and sensors. Including but not limited to contacts, momentary push buttons, limit switches, solenoids, and pressure switches.

Tooele (Required Hours: 270, Credits: 9)	Credits	Hours

TEAM 1260	**Introduction to Manual Machining**	**5.00**	**150.00**

The Introduction to Manual Machining course teaches students to utilize precision measuring instruments, read blueprints, draw simple blueprints, and how to utilize a manual knee mill and lathe. Students will be required to demonstrate and practice the knowledge and skills gained by manufacturing various projects that will be held to specified tolerances.

Objectives:
• Demonstrate safety practices and procedures.
• Utilize precision measuring instruments to document part dimensions on a hand-drawn blueprint.
• Use a manual lathe to machine basic precision round parts that include drilling, tapering, grooving, threading, and basic boring.
• Use a manual knee mill to make basic precision parts utilizing end mills, drills, and taps.

TEAM 1270	**Welding for Automation Technology**	**4.00**	**120.00**

The Welding for Automation Technology course covers the basics to maintain and repair machinery and automated equipment using oxy/fuel, plasma cutting, and welding techniques to fabricate or mend broken parts promptly so that facilities can continue to distribute or produce goods.

Objectives:
• Demonstrate safety practices and procedures.
• Perform basic metal cutting using an oxy-fuel torch, plasma cutter, and a bandsaw on mild steel.
• Perform stringer beads, 50% overlap fillet, pipe to plate, and V-groove welds using the SMAW, GMAW, and FCAW welding processes in the 2F and 1G positions on mild steel.
• Perform stringer beads and fillet welds using the GTAW process in the 2F and 1G positions on mild steel.