UTAH SYSTEM OF HIGHER EDUCATION

Utah System of Higher Education
Control Systems and Robotics
FY2027 / 14 Credits (420 Clock-Hours)

Foundational Courses

TECE 1000 Industrial Networking Basics — 1 Credit / 30 Clock-Hours

This course is designed to help students understand important Ethernet and TCP/IP concepts and terminology. It will also provide essential information about the industrial protocols and topology. Students will gain a solid grasp of Ethernet basics and the concepts required for an Industrial network. The course includes switch configuration, power over Ethernet, addressing, and wireless Ethernet.

Objectives:
- Describe basic network configuration.
- Use basic networking hardware, software, and tools.
- Describe common networking communications protocols.
- Use Power over Ethernet (PoE) in a network application.
- Build and test Ethernet cables.
- Configure a wireless access point.
- Discover and assign Internet Protocol (IP) addresses for various industrial control components.
- Set up a complete Industrial Ethernet network.

TECE 1050 Vision Systems Basic — 1 Credit / 30 Clock-Hours

This course focuses on the Cognex Insight Easy Builder and Spreadsheet application interface with an additional emphasis on lighting, lenses, and filters. With the focus on getting the most from the In-Sight Explorer spreadsheets interface, users learn how to walk through the process of setting up a vision application using spreadsheet programming best practices. Students will learn to use advanced tools and tools recently added to the spreadsheet environment.

Objectives:
- Identify vision hardware and connections.
- Convert pixels to common measurements using calibration tools.
- Setup software interface and acquire first images.
- Identify parts using pattern matching and Logic.
- Identify presence or absence of feature using histogram tools.
- Identify part edges using edge tools.
- Identify irregular shapes using blob tools and image filters.
- Configure input and output signals then demonstrate their use.
- Send process results to external devices.
- Create custom interface for pass/fail results.
- Deploy application using simple interface and advanced interface.
- Demonstrate use of multiple lighting principles and techniques.

TECE 1100 Programmable Logic Controllers II — 3 Credits / 90 Clock-Hours

Programmable Logic Controllers II introduces students to PLC ladder logic and programming, building skills through a series of labs modeled on real industrial applications. Students learn to wire, program, and troubleshoot a variety of systems, culminating in a final project where they program a complete process on an actual machine. By the end of the course, students are equipped to apply more complex logic to controllers.

Objectives:
• Connect to and configure a Programmable Logic Controller (PLC) using PLC programming software.
• Use tags, subroutines, data types, arrays, and sequencer code structure in PLC programming.
• Use input and output instructions, timers, counters, math instructions, and compare instructions in PLC programming.
• Connect and configure input and output (I/O) expansion cards, both local and remote.
• Demonstrate proper PLC wiring.
• Program a complete process from scratch.

TECE 1150 Human Machine Interface (HMI) Programming — 2 Credits / 60 Clock-Hours

Human-Machine Interface (HMI) operator stations have become commonplace in modern industry because they eliminate wiring, enable operator functions to be modified in software, and provide the ability for the operator to monitor PLC operations data. Students will learn how to convert a Programmable Logic Controller program into a graphic Human Machine Interface Panel. Training will cover major topic areas including application editing, tags and communications, creating data logs, input and output objects, local messages and alarms, diagnostics, and information messages.

Objectives:
• Describe the use and need for Human Machine Interface (HMI) in an automation environment.
• Interface an HMI with a Programmable Logic Controller (PLC) to simulate a virtualized system.
• Create graphic displays.
• Build and animate an interactive graphic display.
• Configure HMI tag-based alarms.
• Create and configure a historical trend.
• Create and view a data log model.
• Use a graphic HMI panel to control a process on an actual machine.

TECE 1200 Industrial Networking II **2 Credits / 60 Clock-Hours**

The Industrial Networking II course teaches students how to use industrial networks. Device communication can be one of the most challenging aspects of any automated system. In this course, students will network PLCs, remote I/O blocks, sensor systems, servo drives, and robots so they are able to consistently pass information between devices. This is done through configuring network communication between PLCs and I/O block, sensor systems, servos, and robots. Students who complete this course can setup and maintain an industrial network.

Objectives:
• Apply Industrial Networking concepts to devices used in industry.
• Set up industrial grade networking hardware.
• Configure network communication between Programmable Logic Controllers (PLCs), input and output (I/O) blocks, sensor systems, servos, and robots.
• Use standard PLC sequencer logic to control a process.
• Wire I/O and PLC network connections.
• Set up a remote connection to a PLC.

TECE 1250 Servo Motors and Drives **1 Credit / 30 Clock-Hours**

Introduces servomechanisms to the student. Covers the basic operation of a motion control application. Students will program a servo drive and motor to perform basic motion commands. This course will be directed to configuration and tuning of motion control applications. Students will wire and program an electric motor drive to be self-controlled within a process.

Objectives:
• Describe the components of a servomechanism.
• Use a network to connect a PLC to motion control modules.
• Configure motion modules in a Programmable Logic Controller (PLC).
• Write a PLC program to perform motion control.
• Write a PLC program to perform motion control with multiple axes.

TECE 1800 Integration Capstone **4 Credits / 120 Clock-Hours**

This course will involve many aspects of an industrial control system. Students must complete a high skill level project. Students may be required to design, draw schematics, create flow charts, write progress reports, program a robot, program a Programmable Logic Controller (PLC), program servos, wire devices, or present for their capstone project. This may also include safety systems, risk assessments, and code diagrams. Students may be required to integrate the following items: PLC, HMI, servo drive, network switch, vision system, safety system, and industrial robotic arm. Instructor approval is required for the final project. Working students may propose an on-the-job project contingent on instructor and employer approval.

Objectives:
• Demonstrate advanced troubleshooting techniques.
• Build a project using advanced programming in one or more of the following: Programmable Logic Controllers (PLC), Human Machine Interface (HMI), robots, servos, safety equipment, industrial networking equipment.
• Demonstrate a structured coding method.
• Report the project while following instructor reporting requirements.

Supplemental Courses Varies by Institution

Bridgerland

TECE 1300 Programmable Logic Controllers III **3 Credits / 90 Clock-Hours**

This course will expand on the Programmable Logic Controller II course. This course will cover operation and application of safety programmable logic controllers, safety relays, safety I/O and risk assessments. Students will program a system using PID control methods. Students will be introduced to Structured Text and Function Block programming as well as Add-On instructions. Students will learn how to program using a structured programming method.

Objectives:
• Write a Programmable Logic Controller (PLC) program that uses the PID (Proportional Integral Derivative) method to control a process.
• Program a safety PLC using regular and safety I/O.
• Use an external safety relay in a PLC application.
• Perform a risk assessment.
• Use function block and structured text in basic PLC projects.
• Use Add-On Instructions (AOI) to enhance a PLC program.
• Program a PLC using a structured method.

TECE 1450 Industrial Robot Programming **2 Credits / 60 Clock-Hours**

This course introduces students to the principles and practices of programming industrial robotic manipulators used in manufacturing and automation. Students begin with foundational skills such as powering up, jogging, and creating basic material-handling programs, then progress to advanced applications, including multitasking, error recovery, and system integration. Emphasis is placed on safe operation, troubleshooting, and the development of efficient programming strategies for real-world workcells. Hands-on labs with industrial-grade robots allow students to apply concepts in a practical, project-based setting. Upon completion, students will be prepared to program, operate, and maintain industrial robots in a variety of manufacturing environments.

Objectives:
• Power up, jog, and program an industrial robot using multiple coordinate systems.
• Create, modify, and execute material handling programs with positional accuracy and offsets.
• Apply advanced program control structures, macros, and multi-tasking operations.
• Troubleshoot and recover from common robot and program faults, including error recovery methods.
• Integrate robots with peripheral devices and input/output systems for automated operations.

TECE 1620 Robot Vision and Safety **1 Credit / 30 Clock-Hours**

This course covers the basic tasks and procedures required for an operator, technician, engineer, or programmer to set up, teach, test, and modify iRVision applications and FANUC Dual Check Safety (DCS) software. Upon successful completion of this course, students can identify the components of a vision system, install vision hardware, develop an application, program the robot, perform error recovery procedures, and follow recommended safety practices.

Objectives:
• View and/or change robot and computer parameters to facilitate access to the robot's web page.
• Set up a camera.
• Perform an inspection vision process.
• Understand basic vision concepts and lighting.
• Master a robot using vision mastering.
• Create tool frame for the robot applicator.
• Create user frames necessary for use with the vision system.
• Calibrate a camera.
• Set up a 2D single-view vision process.
• Program the robot to respond to vision results.
• Understand the DCS menus.
• Set up and Modify DCS General parameters.
• Set up position check functions.
• Recover from DCS alarm.
• Modify DCS Zone Checks.
• Setup Stop Position Prediction.
• Create User Models and User Frames.
• Set up and modify Speed Check parameters.
• Set up and Modify DCS Safe I/O parameters.

TECE 2800 Project Based Learning in Controls **1 Credit / 30 Clock-Hours**

The Project Based Learning in Controls course teaches students to develop and complete a project that focuses on an advanced industry skill. Students learn how to stay relevant in an evolving industry through identifying gaps in their skillset, setting measurable progress goals, and demonstrating their competency in a new skill.

Objectives:
• Identify controls skills needed in industry.
• Set measurable goals to increase competency in one of the identified advanced controls topics.
• Report on the project while following reporting requirements.
• Respond to feedback on the project by making adjustments.

Davis

TECE 1300 Programmable Logic Controllers III **3 Credits / 90 Clock-Hours**

This course will expand on the Programmable Logic Controller II course. This course will cover operation and application of safety programmable logic controllers, safety relays, safety I/O and risk assessments. Students will program a system using PID control methods. Students will be introduced to Structured Text and Function Block programming as well as Add-On instructions. Students will learn how to program using a structured programming method.

Objectives:
• Write a Programmable Logic Controller (PLC) program that uses the PID (Proportional Integral Derivative) method to control a process.
• Program a safety PLC using regular and safety I/O.
• Use an external safety relay in a PLC application.
• Perform a risk assessment.
• Use function block and structured text in basic PLC projects.
• Use Add-On Instructions (AOI) to enhance a PLC program.
• Program a PLC using a structured method.

TECE 1420 Programmable Logic Controller Platforms **1 Credit / 30 Clock-Hours**

The Programmable Logic Controller Platforms course helps students to practice using Programmable Logic Controller (PLC) platforms. This course covers how to choose a PLC platform and how to learn the software and hardware of that system. It also goes over how to set up, configure, and program this PLC in a variety of labs simulating industrial applications to provide students with an opportunity to develop their skills. Students who complete this course demonstrate an understanding and ability to program and troubleshoot PLC platforms.

Objectives:
• Use a Programmable Logic Controller (PLC) from a selected manufacturer.
• Perform Programmable Logic Controller programming on a selected platform.
• Use Programmable Logic Controller programming software to create and edit programs on a selected platform.

TECE 1440 Human Machine Interface (HMI) Platforms **1 Credit / 30 Clock-Hours**

The Human Machine Interface (HMI) Platforms course covers how to choose a robot platform from a variety of available Human Machine Interface (HMI) systems. It allows students to perform fundamental HMI tasks with the selected unit. The course also introduces students to the interface, tools, and overall operation of the system from manuals and resources provided by the various vendors, with extensive instructor guidance. Students who complete this course are able to organize, operate, and troubleshoot HMI platforms.

Objectives:
• Use a Human Machine Interface (HMI) or Supervisory Control and Data Acquisition (SCADA) software from a selected manufacturer.
• Configure communication between the selected platform and a Programmable Logic Controller (PLC).
• Create graphic displays on a selected platform.
• Build an interactive graphic display on a selected platform.
• Animate an interactive graphic display on a selected platform.

TECE 1460 Robot Platforms **1 Credit / 30 Clock-Hours**

The Robot Platforms course covers how to choose a robot platform from a variety of available Human Machine Interface (HMI) systems and perform HMI tasks, such as creating, modifying, and executing various programs. With instructor guidance, the course introduces students to the interface, tools, and overall operation of the system from vendor provided manuals and resources. Students who complete this course demonstrate how to operate, alter, maintain, and troubleshoot robot platforms and perform HMI tasks.

Objectives:
• Power up and jog the robot.
• Recover from common program and robot faults.
• Execute production operations.
• Create, modify, and execute a material handling program.
• Monitor, force, and simulate input and output signals.
• Backup and restore individual programs and files.

TECE 1470 Robot Simulation Software **2 Credits / 60 Clock-Hours**

The Robot Simulation Software course introduces procedures for creating a virtual workcell. When completed, the workcell created will contain a robot with end-of-arm tooling, one or more fixtures for holding a part, and a robot TPP Program, which moves the part from one fixture to the other. The course also covers various robot programs and how to run them.

Objectives:
• Create a program using Draw Features on Part.
• Create a program to pick and place random parts.
• Create an AVI of the workcell.
• Add a second robot to the workcell.
• Setup extended axis and add 2nd & 3rd motion group, then create machines for the 7th axis and motion groups.
• Create a program that will trace lines and move blocks.

TECE 1500 FANUC Basic Programming **1 Credit / 30 Clock-Hours**

The course covers the tasks that an operator, technician, engineer, or programmer needs to set up and program a FANUC Robotics Handling Tool Software Package. Students will practice hands-on pendant labs with industrial grade FANUC LR Mate 200i D manipulators and FANUC System R-30i B Mate Controllers.

Objectives:
• Power up and Jog the robot using multiple coordinate systems.
• Recover from common program and robot faults.
• Execute production operations.
• Create, modify, and execute a material handling program.
• Create and execute MACROs.
• Monitor, Force, and Simulate Input and Output Signals.
• Apply positional offsets in a material handling operation.
• Backup and restore individual programs and files.

TECE 1620 Robot Vision and Safety **1 Credit / 30 Clock-Hours**

This course covers the basic tasks and procedures required for an operator, technician, engineer, or programmer to set up, teach, test, and modify iRVision applications and FANUC Dual Check Safety (DCS) software. Upon successful completion of this course, students can identify the components of a vision system, install vision hardware, develop an application, program the robot, perform error recovery procedures, and follow recommended safety practices.

Objectives:
• View and/or change robot and computer parameters to facilitate access to the robot's web page.
• Set up a camera.
• Perform an inspection vision process.
• Understand basic vision concepts and lighting.
• Master a robot using vision mastering.
• Create tool frame for the robot applicator.
• Create user frames necessary for use with the vision system.
• Calibrate a camera.
• Set up a 2D single-view vision process.
• Program the robot to respond to vision results.
• Understand the DCS menus.
• Set up and Modify DCS General parameters.
• Set up position check functions.
• Recover from DCS alarm.
• Modify DCS Zone Checks.
• Setup Stop Position Prediction.
• Create User Models and User Frames.
• Set up and modify Speed Check parameters.
• Set up and Modify DCS Safe I/O parameters.

TECE 1700 FANUC Advanced Programming **1 Credit / 30 Clock-Hours**

Advanced programming is the next step after a basic programming class. Topics from the previous classes will be used in this class to develop a more complex scenario. Students will be given a hypothetical example workcell. They will then be given the task of creating all the necessary programs to deal with multifaceted issues using advanced programming techniques.

Objectives:
• Manipulate frames related to programming issues.
• Demonstrate advanced program control structures.
• Establish PLC Robot communication using User Operator Panel.
• Master the robot.
• Establish Ethernet communication.
• Set payload and payload change.
• Set tool frame offsets.
• Apply reference positions.
• Pull parts through a predefined system.
• Set up multi-tasking operations.
• Design and implement methods for Error Recovery.

TECE 1720 Controls Integration **3 Credits / 90 Clock-Hours**

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
• Describe the mechanics of installing sensors and actuators in machine
• Practice simulating your system with PLC Logics
• Test and analyze the feasibility of the project
• Build and integrate automated equipment

Ogden-Weber

TEAM 1010 Essential Skills and Safety **3 Credits / 90 Clock-Hours**

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 Credits / 60 Clock-Hours**

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 Credits / 60 Clock-Hours**

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 Credits / 90 Clock-Hours**

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 Credits / 60 Clock-Hours**

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 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.

TEAM 2146 Electrical Fluid Power Control Systems — 2 Credits / 60 Clock-Hours

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. Students will explore components to set up a variety of industrial relay control circuits using ladder diagrams and Boolean logic. Some of these components include selector, pushbutton, limit, and pressure switches; control and timer relays; and hydraulic and pneumatic directional control valves.

Objectives:
• Explain the fundamentals of electro-hydraulic systems by identifying key components, such as relay controls and solenoid-operated hydraulic valves.
• Implement control systems using electrical devices like pushbuttons, selector switches, and indicator lights to achieve specific hydraulic circuit outcomes.
• Demonstrate proficiency in interpreting and creating ladder diagram schematics for electro-hydraulic control circuits.
• Analyze and design basic and intermediate hydraulic circuits incorporating electrical control relays, sequencing control, and time-delay functions.
• Demonstrate the operation of solenoid-operated directional control valves (DCVs) to manage the flow and direction in hydraulic circuits.
• Troubleshoot power and control circuits using sequencing, timer, and pressure control applications to ensure proper performance and function.

TEAM 1070 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.

TEAM 1080 Applied System Diagnostics **2 Credits / 60 Clock-Hours**

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.

TEAM 1140 Industrial Robotics **3 Credits / 90 Clock-Hours**

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 1300 Building Control Panels **3 Credits / 90 Clock-Hours**

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 1138 Vision Systems **1 Credit / 30 Clock-Hours**

This course will identify vision safety topics and basic functions of vision systems for two different platforms. It will demonstrate how to manipulate and use imaging software, as well as describe the set-up scanning features, profiles, and tools. It will also introduce 2□Dimensional and 3□Dimensional imaging.

Objectives:
• Navigate the Cognex Insight platform.
• Navigate the Keyence platform.
• Set up a vision program utilizing the most innovative systems.
• Demonstrate proper function of scanning, profile, pattern, and dimensioning tools.

TEDR 1200 Parametric Solid Modeling **3 Credits / 90 Clock-Hours**

The Parametric Solid Modeling course explores parametric solid modeling, a process of feature and dimension driven design, for the creation of basic models. Students will learn about model/drawing association, best modeling practices, and industry standards.

Objectives:
● Use commands and modeling strategies to create solid model parts and assemblies.
● Define terminology and processes related to parametric modeling.
● Develop drawings from created models.
● Interpret engineering design intent.
● Identify areas for review and iteration through redlining.

TEWT 1311 Gas Metal Arc Welding (GMAW) I **2 Credits / 60 Clock-Hours**

This course teaches set-up, operation, and practical application of GMAW. Process advantages and limitations are discussed. Students receive hands-on instruction regarding GMAW standard procedures and best practice in accordance with industry standards using short-circuiting and axial spray metal transfer modes.

Objectives:
• Demonstrate safety and best practices of GMAW-specific welding.
• Setup and operate appropriate GMAW equipment.
• Identify process advantages and limitations.
• Perform 1F, 1G, 2F and 2G welds using GMAW-S.
• Perform 1F, 1G, and 2F welds using GMAW axial spray transfer.

TECE 1700 FANUC Advanced Programming **1 Credit / 30 Clock-Hours**

Advanced programming is the next step after a basic programming class. Topics from the previous classes will be used in this class to develop a more complex scenario. Students will be given a hypothetical example workcell. They will then be given the task of creating all the necessary programs to deal with multifaceted issues using advanced programming techniques.

Objectives:
• Manipulate frames related to programming issues.
• Demonstrate advanced program control structures.
• Establish PLC Robot communication using User Operator Panel.
• Master the robot.
• Establish Ethernet communication.
• Set payload and payload change.
• Set tool frame offsets.
• Apply reference positions.
• Pull parts through a predefined system.
• Set up multi-tasking operations.
• Design and implement methods for Error Recovery.

TECE 2010 Allen-Bradley Programmable Logic Controllers III **3 Credits / 90 Clock-Hours**

This course will demonstrate troubleshooting programmable logic controllers (PLCs) using the RSLogix5000 platform. Techniques are introduced that help facilitate correcting minor program and hardware issues that may be encountered in the workplace.

Objectives:
- Using the Studio 5000 programming environment to monitor, create, upload, download, and troubleshoot CompactLogix PLC programs.
- Configure connected devices such as local I/O, remote I/O, and VFD’s connected via Ethernet/IP.
- Introduce troubleshooting concepts
- Enhance troubleshooting skills with real world problems
- Demonstrate skills with regards to configuring and troubleshooting software and hardware
- Configure, download, and monitor PLC operation via an HMI

TECE 2110 Siemens Programmable Logic Controllers II **3 Credits / 90 Clock-Hours**

This course offers concepts on troubleshooting programmable logic controllers (PLCs) using the TIA-Portal platform. This course demonstrates techniques that help facilitate correcting minor program and hardware issues that may be encountered in the workplace.

Objectives:
- Using the TIA Portal programming environment to monitor, create, upload, download, and troubleshoot CompactLogix PLC programs.
- Configure connected devices such as local I/O, remote I/O, and VFD’s connected via Ethernet/IP.
- Introduce troubleshooting concepts
- Enhance troubleshooting real-world problems
- Demonstrate configuring and troubleshooting software and hardware skills
- Configure, download, and monitor PLC operation via an HMI

TECE 2210 Siemens Programmable Logic Controllers III **3 Credits / 90 Clock-Hours**

This course will introduce topics to program Siemens programmable logic controllers (PLCs) using the TIAPortal platform. It will describe how to interpret and troubleshoot complex problems.

Objectives:
- Introduce students to design and troubleshooting concepts
- Enhance troubleshooting of real-world problems
- Utilize PLC/HMI code objects to improve system integration capabilities.
- Pass data between control systems via Produced/Consumed tags and/or message instructions.
- Configure HMI faceplate objects and function block code.
- Test skills on software and hardware

TECE 2150 Mechatronics **3 Credits / 90 Clock-Hours**

Students in this course will learn multifaceted automation systems comprised of pneumatics, electrical, programmable logic controllers (PLCs), and tabletop systems. Students will be introduced to inventory, inspection, distribution, and servo robots. Students will learn combination automation, where many systems work together as a complete system process.

Objectives:
- Demonstrate the integration of mechanical, electrical, computer, and control principles in designing complex systems.
- Gain knowledge of mechanical components, such as sensors, actuators, and mechanisms, and their applications in creating automated systems.
- Develop skills in integrating different components to design and build complete mechatronic systems.

TECE 1400 Instrumentation Process Control **2 Credits / 60 Clock-Hours**

This course describes how to precisely control liquids and gases in a wide variety of industrial applications including power generation, petrochemicals, and manufacturing. Additionally, this course will offer information about topics such as flow rate, pressure, temperature, liquid level, density, and PH in industrial applications.

Objectives:
- Understanding sensors, actuators, controllers, and instrumentation used in process control systems.
- Describes final control elements, level sensor operation, and liquid level control.
- Deliver new methods of automatic controls, basic flow measurement and control, and control loop performance.
- Proportional Integral Derivative (PID) controllers, tuning methods, and their application in regulating industrial processes.

TECE 1410 Instrumentation Pressure Control **2 Credits / 60 Clock-Hours**

This course will show how to control liquid level and tank pressure simultaneously using a human machine interface (HMI) programmable automation controller (PAC) and variable frequency drive (VFD) that are found in real-world industrial fields.
Objectives:
• Study the concepts incorporated with pressure process controls systems.
• Utilize specialized equipment to control loop performance, open and closed loop tuning, process system alarms, and performance concepts.
• Use instrument index, final control elements and pressure measurement.
• Practice real-world pressure control using industrial grade components and equipment specifically for pressure process control industries.

TECE 1415 Instrumentation Thermal Control **2 Credits / 60 Clock-Hours**

This course will utilize one of the most common types of process control systems, temperature control. This course will offer information with regards to calibration, adjusting, installing, operating, and tuning thermal process control systems in industrial applications.
Objectives:
• Use special thermal instruments and tools to control the temperature of water flowing in the process loop.
• Measure signals and connect the devices in a wide variety of control configurations including PID control, on/off control, and manual control.
• Utilize different process controls for temperature including thermocouples, thermistors, and RTD.
• Effectively study temperature-controlled processes with a wider temperature range than air-cooling alone

TECE 1010 Machine Safety Integration **1 Credit / 30 Clock-Hours**

This course introduces the principles and practices of machine safety integration in automated industrial environments. Students learn how to apply safety standards, select and configure safety components, and integrate safety systems into existing machinery. The course blends core theory with hands-on work, including wiring, programming, testing, and troubleshooting safety devices and safety logic. Emphasis is placed on proper risk reduction, compliant system design, and reliable machine operation.

Course Objectives
- Interpret and apply machine safety standards relevant to automated equipment.
- Identify common safety components such as emergency stops, light curtains, safety relays, safety PLCs, interlocks, and guarding systems.
- Integrate safety devices into industrial machinery using correct wiring, configuration, and verification procedures.
- Program and test basic safety logic, including safe start, safe stop, reset conditions, and fault handling.
- Evaluate machine risks and verify that safety systems function as intended.
- Troubleshoot common failures in safety circuits and restore safe operation.

TECE 1130 Autonomous Mobile Robots **1 Credit / 30 Clock-Hours**

Students will learn key concepts in robotics, including sensors, control systems, localization, path planning, and machine learning. Through hands-on projects, learners will gain practical experience programming and testing AMRs in real-world scenarios, preparing them for careers in robotics and automation.

Objectives:
- Demonstrate an understanding of safety protocols, risk assessment, and emergency procedures for integrating autonomous mobile robots in industrial environments.
- Configure and operate AMR software interfaces, including navigation, fleet management, and remote monitoring systems for real-time operational control.
- Apply mapping techniques to enable accurate navigation and obstacle avoidance in dynamic environments.
- Execute troubleshooting procedures to ensure optimal AMR performance and minimize downtime.
- Integrate AMRs with existing automation systems, optimizing workflows through IoT connectivity