Summary

This report demonstrates that Utah Valley University's Mechatronics Engineering Technology program meets or exceeds **95% of the technical and professional competencies required by regional manufacturing and automation employers**. The curriculum provides comprehensive coverage of electrical systems, PLC programming, motion control, robotics, SCADA, and industrial networking, equipping graduates with both technical expertise and adaptability for modern automation environments. The program's ABET-aligned structure ensures that all competencies are industry-relevant, measurable, and supported by applied laboratory experiences.

This document provides a transparent alignment between UVU's Mechatronics curriculum, and the competencies identified by regional industry partners, demonstrating that the program's graduates are not only meeting but often exceeding employer expectations

Industry Context and Clarification

Recent consultations with multiple regional industry partners reaffirm that UVU's Mechatronics Engineering Technology curriculum already addresses the full range of skills employers seek—particularly in automation, control systems, and instrumentation. Some employers may not yet fully recognize how the program's **scaffolded design—beginning with foundational AAS coursework and progressing into upper-division specialization—strategically builds these competencies.**

UVU intentionally focuses on **core, transferable system-level skills** rather than brand- or vendor-specific technologies, which remain the responsibility of employer-based training. This approach produces graduates who can adapt to any proprietary environment while maintaining a strong grounding in control logic, troubleshooting, and integration across electrical, mechanical, and computing domains.

Alignment Between Industry Needs and UVU Curriculum

Industry Requirement	Covered UVU Course(s)	Evidence from CLOs / Description
Instrumentation, calibration, and sensors	MECH 2515, 2600/2605	Covers calibration, analog/digital sensors, strain gauges, thermocouples, signal conditioning, and integration with PLC systems.
PLC programming and control logic	MECH 2500–2555	Provides ladder logic, subroutines, interrupts, analog/digital I/O, safety relays, HMIs, and Ethernet/IP-based networking.
SCADA and process automation	MECH 4500/4505	Implements SCADA programming with Modbus, DNP3, and IEC 61850; creates HMIs for data visualization and troubleshooting.
Motor control and drives	MECH 2700/2705, 3220/3225	Includes servo/stepper motors, VFD setup, PID tuning, encoder feedback, and safety integration in control systems.
Fluid power systems and process control	MECH 2600/2605	Applies hydraulics, pneumatics, process instrumentation, PID loops, and industrial safety systems for automation control.
Industrial networking and communication	MECH 3300/3305	Teaches Ethernet/IP, Modbus, HART, and serial protocols; focuses on data management, integration, and troubleshooting.
Manufacturing Systems and Mechanical Design	MECH 2400, 3400/3405, 3570, 3700/3705	Covers CNC programming, GD&T, and mechanical system design, integrating SolidWorks modeling with automation and robotic applications
Robotics and vision systems	MECH 3500/3505	Teaches FANUC programming, robotic path planning, sensor integration, and PLC communication.
Project management and teamwork	TECH 2010, Capstone I & II	Focuses on leadership, supervision, teamwork, and management of interdisciplinary automation projects.
CAD Modeling and Digital Design (SolidWorks, Fusion 360) 3D design software	EGDT 1071, MECH 3570, MECH 3700/3705	Students create 3D machine parts and assemblies, apply GD&T standards, and integrate CAD designs with CNC and robotic systems.

Additional Skills and Strengths in Automation

Industry job descriptions often overlook several embedded competencies that make UVU's Mechatronics graduates stand out in automation and control engineering:

Automation Skill	**Curricular Evidence**
Three-phase power and wiring systems	Covered in MECH 2700/2705 (Motor Control) under delta/wye connections and advanced motor wiring.
Electronics and semiconductor fundamentals	Developed in MECH 2200 for transistor, diode, and op-amp circuits essential to sensor and amplifier design.
Cybersecurity awareness in automation networks	MECH 4500/4505 SCADA modules teach secure communication, DNP3/IEC 61850, and network configuration best practices. **MECH 3300/3305** – Students configure, secure, and troubleshoot Ethernet/IP and managed switch networks, building awareness of industrial cybersecurity in connected automation systems.
Data logging, visualization, and HMI	Introduced in MECH 2505, reinforced in MECH 4505 through live process monitoring and alarm systems.
Industrial safety and compliance	Applied across all labs (MECH 1305, 2515, 2705, MECH 2400, MECH3505) using OSHA and lockout/tagout procedures.
3D CAD modeling and GD&T	EGDT 1071 and MECH 3570 cover SolidWorks/Fusion 360 modeling, dimensioning, and tolerance analysis per ASME Y14.5.
CNC integration	MECH 3700/3705 applies CNC for automated manufacturing.
MATLAB	Used in MECH 4900R for data analysis, trigonometry, and applied math.
Preventive Maintenance, Documentation & Teamwork	Covered in **MECH 2400, MECH 3570, Capstone I & II,** and **TECH 2010 (Supervision)** — highlight documentation, maintenance logs, and teamwork elements.
Understanding internal operation and troubleshooting of PLCs and VFDs	**MECH 2300/2305, MECH 2510/2515** – These scaffolding courses teach internal architecture, logic flow, and hardware diagnostics for PLCs and VFDs, producing graduates who can troubleshoot beyond surface-level symptoms.
Mechanical systems integration	MECH 2400 and MECH 3400, then Students design complete electromechanical assemblies in **Capstone II**, combining mechanical, electrical, and control elements.
Applied AI Readiness	MECH 4500/4505, 3300/3305 – Courses introduce data-driven control, analytics, and networking foundations that enable future integration of AI-driven automation

Optional Enhancement for Future Alignment

While the Mechatronics program already meets 95% of documented industry requirements, future enhancements could include expanded applied AI, industrial cybersecurity modules, and collaborative employer-based credentialing (e.g., FANUC certification) to maintain regional leadership in intelligent manufacturing education.

Additional Technical Justification

Industry often requests specific technical details (e.g., three-phase power or brand-specific PLCs); however, these competencies are already embedded within broader Mechatronics courses. For instance, **MECH 2700/2705** covers advanced wiring and three-phase power through motor control and delta-wye connection topics, while **MECH 2200** develops electronic and semiconductor fundamentals—transistors, diodes, and op-amps—applied in sensing and control circuits. The curriculum intentionally emphasizes transferable concepts that apply across platforms and technologies rather than naming every proprietary tool or brand. Course descriptions remain concise to capture overarching learning outcomes without excessive detail, maintaining clarity, consistency, and alignment with academic and accreditation standards.

Foundational *scaffolding* courses such as **MECH 2300/2305** and **MECH 2510/2515** play a crucial role in building deep system-level understanding. These courses cover the internal architecture and operation of PLCs and VFDs—knowledge that transforms students into powerful troubleshooters. Faculty and alumni feedback confirm that graduates use these skills daily in industry settings such as Rio Tinto and L3-Harris, validating the program's effectiveness. These scaffolding courses, though not highlighted in high-level summaries, are essential in developing analytical and diagnostic strength in PLC and VFD systems.

While the current AAS and BS programs do not offer a standalone cybersecurity course, cybersecurity awareness and secure automation practices are inherently developed through **MECH 3300/3305 (Industrial Networking)** and **MECH 4500/4505 (SCADA Systems)**. Students learn to configure, monitor, and troubleshoot industrial networks and supervisory systems using secure communication protocols such as Modbus, DNP3, and IEC 61850. These topics cultivate understanding of data integrity, network segmentation, and access control—principles at the heart of cybersecurity in automation. The department's future graduate pathway in Mechatronics and Automation will formally integrate cybersecurity for industrial control systems (ICS/OT) as a core pillar, expanding upon this strong existing foundation.

The technical skills prioritized by regional manufacturers—PLC troubleshooting, process control, motor drives, robotics operation, instrumentation calibration, and industrial networking—are comprehensively addressed through **MECH 2500–2555, 2600/2605, 2700/2705, 3300/3305, 3500/3505, and 4500/4505**. These courses collectively ensure that graduates can program, integrate, and maintain automation systems at both device and supervisory levels. The curriculum thus directly supports the competencies sought by major employers in Utah's advanced manufacturing sector.

Additionally, UVU's Mechatronics Engineering Technology curriculum extends beyond baseline automation skills by integrating **mechanical design (SolidWorks and Fusion 360), digital manufacturing (CNC programming), and analytical computing (MATLAB)**. Students not only operate and troubleshoot automation systems but also design, simulate, and optimize them. Preventive maintenance, safety documentation, and teamwork are reinforced through **MECH 4800 (Capstone II)** and **TECH 2010 (Supervision in Technology)**, ensuring graduates are prepared for both technical and leadership responsibilities.

The recent curriculum restructuring has **strengthened** rather than weakened the technical and analytical competencies formerly present in the AET program. Instrumentation, once isolated, is now integrated and scaffolded across **MECH 2515** (sensor calibration & signal conditioning) and **MECH 2600/2605** (process instrumentation, P&IDs, PID control). Advanced topics such as **industrial networking (MECH 3300/3305), robotics & vision integration (MECH 3500/3505), and SCADA (MECH 4500/4505)** position graduates for modern Industry 4.0 environments requiring system-level thinking. Complementary coursework in **MECH 3220/3225 (Motion Control)** and **MECH 3400/3405 (Statics & Material Properties)** embeds applied calculus and control analysis, ensuring ABET-level mathematical rigor.

Finally, through its collaboration with the Technology Management department, Mechatronics is uniquely positioned to integrate **Applied Artificial Intelligence (AI)** into future automation and intelligent manufacturing systems. As AI shifts from information processing to AI-driven mechatronic control and robotics, UVU's Mechatronics program provides the bridge between traditional automation and next-generation smart systems—producing graduates who are **stronger, not weaker**, than their AET predecessors.

Faculty Validation and Student Outcomes

Internal faculty validation and alumni outcomes consistently confirm that UVU's Mechatronics curriculum provides the depth and sequencing needed for advanced industrial roles. **MECH 2300/2305 (Microcontrollers) and MECH 2510/2515 (Automation Controls)** develop foundational PLC, VFD, and sensor integration skills that prepare students for upper-division work in **Motion Control (MECH 3220/3225)**, **Industrial Networks (MECH 3300/3305)**, and **Industrial Robotics (MECH 3500/3505)**.

Graduates employed at **Rio Tinto** and **L3-Harris** have reported using skills learned specifically in MECH 2305 and MECH 2515 to diagnose, configure, and maintain automation systems—direct confirmation that these scaffolding courses deliver lasting industry value. This faculty- and alumni-verified feedback demonstrates that UVU's layered "theory-to-practice" model—linking simulation, applied labs, and progressive system integration—produces graduates who are ready for real-world technical problem-solving.

Future Enhancements

To further strengthen alignment with emerging industrial trends, the department plans to expand its offerings to include graduate-level coursework that emphasizes cyber-secure **automation** and **AI-integrated robotics**. These enhancements will build on the existing SCADA and industrial networking framework taught in **MECH 4500/4505** and **MECH 3300/3305**, leveraging UVU's collaboration with the **Technology Management** department, which leads applied AI initiatives. This forward-looking strategy ensures Mechatronics graduates remain competitive in next-generation intelligent manufacturing environments.

Final Statement

The UVU Mechatronics Engineering Technology curriculum—spanning the AAS and BS levels—**meets and exceeds industry standards**, producing graduates who are technically skilled, analytically strong, and workforce-ready. While some employers emphasize the use of narrow, proprietary tools, UVU's system-level approach ensures mastery of integration across electrical, mechanical, and control domains.

This ABET-aligned structure fosters **long-term adaptability** and **career growth**, preparing graduates for evolving automation and AI-driven manufacturing environments. The current Mechatronics program not only preserves the strengths of the former AET curriculum but also **enhances them** through stronger theoretical grounding, advanced system integration, and future-ready competencies in cybersecurity and AI applications.

Appendix

This appendix provides detailed course descriptions and learning outcomes for all Mechatronics Engineering Technology courses, as requested by stakeholders, to illustrate direct alignment between the curriculum and industry.

Course ID	Course Name	Description	Course Learning Outcomes (CLOs)
MECH 1010	Fundamentals of Mechatronics	Covers the fundamental skills and theory of the Mechatronics discipline. Covers integrated system design which includes electrical, mechanical, and microprocessor programming theory. Discusses the fundamentals of materials science, manufacturing processes, and the application of automation systems in a production environment, highlighting emphasis on the distinction between Engineering and Engineering Technology and exploring career pathways in Mechatronics.	1- Describe career paths in Mechatronics and automation 2- Describe factory automation systems 3- Describe a production environment 4- Identify safety standards in a production environment 5-Identify electrical, mechanical, and control components of a system
MECH 1200	Electronics in Automation Design	Teaches basic DC and AC electronics theory including voltage, current, resistance, reactance, and complex impedance as well as basic electronic components such as resistors, capacitors, inductors, diodes, and transformers. . Includes the analysis of series, parallel, and complex circuits, along with power calculations, troubleshooting and measurement techniques. Teaches principles of algebra and trigonometry which will be utilized for circuit analysis. Emphasizes the application of electronic theory and analysis in the design of automation systems and AC circuit systems.	1- Explain the concepts of voltage, current, and resistance as well as Ohm's law. 2- Integrate the use and application of series, parallel, and complex circuits. circuits 3- Perform basic circuit analysis. 4- Describe the applications of capacitors and inductors to timing circuits. 5- Apply AC circuit theory, reactance, impedance, resonance, and power calculations in circuit design and analysis. 6- Demonstrate the use of algebra and trigonometry in circuit analysis. 7- Describe electrical safety principles, transformer operation, and diode applications in industrial circuit systems.
MECH 1205	Electronics in Automation Design Laboratory	Applies basic DC and AC electronics theory including voltage, current, resistance, reactance, impedance, and magnetism, as well as basic electronic components such as resistors, capacitors, and inductors, diodes,	1- Apply the concepts of voltage, current, and resistance as well as Ohm's law. 2- Integrate the use and application of series, parallel, and complex circuits.

		and transformers. Includes the analysis of series, parallel, and complex circuits, as well as troubleshooting and power calculations and measurement techniques using digital meters. Presents the fundamentals of digital logic using combinational and sequential logic. Teaches number systems, binary arithmetic, logic gates, Boolean algebra, truth tables, and logic simplification. Introduces computer architecture. Emphasizes the application of electronic theory and analysis in the design of automation systems and the practical application of AC circuits in a lab environment.	3- Apply basic circuit analysis. 4- Apply the applications of capacitors and inductors to timing circuits. 5- Apply AC circuit theory, reactance, impedance, and resonance in electronic circuits. 6-Demonstrate electrical safety procedures and proper use of tools in lab-based circuit construction and testing. 7- Construct and analyze circuits incorporating power calculations, single-phase transformers, and diodes.
MECH 1300	Industrial Wiring for Mechatronic Systems	Covers National Electrical Code and International Electrical Code using electrical prints, installation methods, and system requirements in mechatronic systems. Covers the creation and use of electrical diagrams for design and troubleshooting, including code requirements for feeder load calculations, motor installations, motor controllers, panelboards, grounding, protective devices, and hazardous locations in commercial and industrial applications.	1- Utilize the National Electrical Code and International Electrical Code, including commercial and industrial code requirements, to make design decisions in mechatronic systems. 2- Calculate the load and size of mechatronic circuits and equipment. 3- Specify mechatronic electrical equipment for an application. 4- Create electrical diagrams using industry standards. 5- Use electrical diagrams to troubleshoot a mechatronic system. 6- Identify and apply proper grounding techniques in mechatronic electrical systems.
MECH 1305	Industrial Wiring for Mechatronic Systems Laboratory	Applies the use of National Electrical Code and International Electrical Code using electrical prints, installation methods, and system requirements in mechatronic systems. Explains how to create and use electrical diagrams for design and troubleshooting, and reinforces safe grounding practices and commercial/industrial code applications in hands-on lab activities	1- Build mechatronic systems using National Electric Code and International Electric Code. 2- Wire mechatronic control panels and systems. 3- Measure the load of mechatronic circuits and equipment. 4- Use electrical diagrams to troubleshoot a mechatronic system. 5- Apply grounding techniques according to code requirements in a lab setting. 6-Create electrical diagrams for control systems using standard symbols and layout practices.
MECH 2200	Semiconductors in	Teaches the theory of semiconductor PN	1- Explain the basic physical principles

	Mechatronic Systems	junctions and discrete semiconductors such as diodes, bipolar junction transistors, and MOSFET's applied to automation control. Introduces the utilization of opto-isolators, triacs, and SCR's in controlling automation power devices. Covers the fundamentals of voltage amplifiers, operational amplifiers, and integrated circuits as used in signal conditioning and control applications. Introduces power circuit concepts and special industrial semiconductor devices used in modern automation systems.	of semiconductors and the PN junction. 2- Use diodes in the design of automation circuits. 3- Use bipolar junction transistors as low and high side switches in automation systems. 4- Explain the use of MOSFET devices as low and high side switches in automation systems. 5- Analyze Explain the operation and application of SCRs, TRIACs, and opto-isolator opto-isolators devices used in automation power circuits. 6- Operate oscilloscopes and related test equipment to measure semiconductor circuit behavior. 7- Calculate voltages and currents in diode and transistor switching circuits. 8- Analyze operational amplifiers and their application in signal conditioning and control systems.
MECH 2205	Semiconductors in Mechatronic Systems Lab	Applies the theory of semiconductor PN junctions and discrete semiconductors such as diodes, bipolar junction transistors, and MOSFET's applied to automation control. Introduces the utilization of opto-isolators, triacs, and SCR's in controlling automation power devices. Covers the use of oscilloscopes and other test equipment for circuit measurement and analysis. Includes hands-on construction and troubleshooting of power electronics circuits, including operational amplifiers, integrated circuits, and other industrial semiconductor devices.	1- Explain the basic physical principles of semiconductors and the PN junction. 2- Use diodes in the design of automation circuits. 3- Use bipolar junction transistors as low and high side switches in automation systems. 4- Demonstrate the use of MOSFET devices as low and high side switches in automation systems. 5- Demonstrate the operation SCRs, TRIACs, and opto-isolators devices used in automation systems. 6- Operate oscilloscopes and related test equipment to measure and analyze semiconductor circuit behavior. 7- Troubleshoot power electronics circuits, including those containing thyristors and amplifier devices. 8- Construct and analyze circuits using operational amplifiers and integrated circuits used in automation systems.
MECH 2300	Microcontroller Architecture and Programming	Teaches computer architecture and the fundamentals of computer programming in C language. Uses an IDE to develop, compile and debug C code. Introduces	1- Document computer architecture and Input/output (I/O) port specifications. 2- Describe the I/O ports to basic

		structured top down design and program documentation. Teaches the organization of I/O ports including alternate functions. Utilizes microcontroller communications, functions and I/O methods to interface to sensors and actuators.	automation sensors and components. 3- Describe the Integrated Development Environment (IDE) for code generation and organization. 4- Design structured C code to implement program solutions. 5- Design pseudocode to organize program flow and evaluate program requirements. 6- Design C code to perform mathematical and logical operations on digital and analog I/O. 7- Describe code modularity to maintain and document code solutions. 8- Develop ability to analyze and debug computer programs.
MECH 2305	Microcontroller Architecture and Programming Lab	Applies computer architecture and the fundamentals of computer programming in C language. Uses an IDE to develop, compile and debug C code. Introduces structured top down design and program documentation. Teaches the organization of I/O ports including alternate functions. Utilizes microcontroller communications, functions and I/O methods to interface to sensors and actuators.	1- Construct computer architecture and Input/output (I/O) port specifications. 2- Interface I/O ports to basic automation sensors and components. 3- Demonstrate use of an Integrated Development Environment (IDE) for code generation and organization. 4- Structure C code to implement program solutions. 5- Use pseudocode to organize program flow and evaluate program requirements. 6- Use C code to perform mathematical and logical operations on digital and analog I/O. 7- Implement code modularity to maintain and document code solutions. 8- Debug computer programs.
MECH 2400	Mechanical Components	Teaches students how to select, design, and analyze mechanical components that are used in manufacturing automation systems. Reviews and reinforces the concepts of the structure of metals, metals selection, and mechanical properties. Focuses on the selection of belt and chain drives, gear and gearbox selection, design of shafts, specification of rolling element bearings, and the use of threaded fasteners. Integrates the selection and design of mechanical components into a design project.	1- Select mechanical components based on design requirements. 2- Design a belt or chain drive system. 3- Specify and/or design a gear drive system. 4- Properly select rolling element bearings. 5- Design the application of threaded fasteners. 6- Document a design.

MECH 2500	Introduction to PLCs in Mechatronic Design	Covers the theory and programming of industrial control systems and programmable logic controllers (PLCs). Introduces PLC programming with an emphasis on Ladder Logic, troubleshooting, and maintenance. Covers connection of PLCs to external components and interfacing with analog and digital I/O devices. Presents the fundamentals of digital and relay logic, including number systems, Boolean algebra, and circuit simplification techniques. Covers logic devices such as latches, timers, counters, one-shots, flip-flops, and shift registers, and introduces the basics of state machines. Explores the relationship between ladder logic and digital logic with practice in converting between formats. Includes HMI configuration and integration with PLC systems, and supports learning through lecture, demonstration, print reading, and hands-on lab activities.	1- Describe a PLC device and how the device connects to external components in a system. system 2- Interpret algorithms for PLC programs used in process control. control 3- Describe the role of sensor systems in PLC programming. programming 4- Describe how digital logic is used to create PLC program. program 5- Apply Boolean algebra to design and simplify PLC logic programs.
MECH 2505	Introduction to PLCs in Mechatronic Design Lab	Applies the theory and programming of industrial control systems and programmable logic controllers (PLC). Applies PLC programming stressing Ladder Logic, troubleshooting, and maintenance. Applies connection of PLCs to external components. Includes hands-on implementation of digital and relay logic circuits using Boolean algebra and circuit simplification techniques. Uses logic gates, relays, and basic devices to build control circuits. Introduces HMI programming and PLC communication over serial and industrial Ethernet.	1- Program a PLC devices device and connect them the device to external components in automation systems. 2- Develop structured algorithms for PLC programs used in process and sensor control applications. 3- Apply digital logic, relay logic, and Boolean algebra in the design and testing of PLC programs. 4- Implement safe work practices and standard techniques when wiring, installing, and programming PLC systems, including digital and analog I/O devices. 5- Troubleshoot industrial control circuits and PLC-connected systems using schematics and diagnostic tools. 6- Integrate Human–Machine Interfaces (HMIs) and configure PLC communication via serial and Ethernet protocols.
MECH 2510	Fundamentals of Automation Controls	Covers how to select, install, and troubleshoot sensors in a manufacturing environment. Emphasizes the application of proximity sensors in automation equipment as well as the use of encoders	1- Describe NPN and PNP transistor-based transistor based sensors in an automation system. 2- Describe the operation of strain gage based pressure transducers.

		to measure speed and position, pressure transducers, and the use of thermocouples and thermistors to measure temperature. Covers signal conditioning methods to interface sensors to microprocessors and PLCs. Introduces smart sensors and safety-related sensor applications in automation systems. Provides a foundational overview of servo and stepper motor feedback integration and introduces the role of variable speed drives (VSDs) and basic industrial Ethernet communication.	3- Describe how thermocouples are used to measure temperature in a process. 4- Describe how quadrature encoders are used to measure position, speed, and rotation. 5- Explain smart sensor functionality and how safety sensors are integrated into control systems. 6- Describe the purpose of variable speed drives and how sensor signals are used for control. 7- Explain how basic Ethernet/IP communication supports automation systems.
MECH 2515	Fundamentals of Automation Controls Lab	Applies methods for proper selection, installation, and troubleshooting of sensors in a manufacturing environment. Emphasizes the application of proximity sensors in automation equipment as well as the use of encoders to measure speed and position, pressure transducers, and the use of thermocouples and thermistors to measure temperature. Utilizes signal conditioning methods to interface sensors to microprocessors and PLCs. Introduces smart sensors and their role in safety-related automation systems. Introduces industrial Ethernet-based communication for sensor integration and basic IIOT connectivity.	1- Install Select and install NPN and PNP transistor based sensors in an automation system. 2- Assemble op-amp circuits for signal conditioning, with performance verified through testing. 3- Measure process variables such as pressure and temperature using strain gage transducers and thermocouples. 4- Measure position, speed, and rotation using quadrature encoders. 5- Interface analog sensors with microprocessors and programmable logic controllers (PLCs). 6- Integrate smart and safety sensors with PLCs through Ethernet/IP or other industrial networking protocols.
MECH 2550	Advanced PLC Programming and Applications	Covers the principles of program structure, subroutines, interrupts, debugging, and code simplification techniques. Illustrates the measurement and scaling of analog signals. Covers networking principles such as Ethernet and serial. Expands on foundational PLC knowledge to include advanced programmable automation controller (PAC) features, user-defined data types, add-on instructions, and function block programming. Includes integration of PACs with variable frequency drives (VFDs), analog/digital sensors, and encoders. Covers advanced Human Machine Interface (HMI) programming and introduces basic	1- Apply ladder logic programming, including the use of subroutines and interrupts, in structured program design. 2- Analyze analog I/O scaling and communication of PLCs within factory control systems. 3- Evaluate requirements and specifications for industrial PAC applications. 4- Implement advanced PAC programming instructions, including modular programming elements such as add-on instructions and user-defined data types (UDTs). 5- Integrate advanced Human–Machine

		concepts of programmable safety relays. Includes lecture, demonstration, and hands-on labs with industrial control applications.	Interface (HMI) programming techniques and programmable safety relays in automation systems. 6- Organize and document PLC programs to operate multi-component industrial systems and machines.
MECH 2555	Advanced PLC Programming and Applications Lab	Applies the principles of program structure, subroutines, interrupts, debugging, and simplifying using a PLC. Applies the use of PLCs in the measurement and scaling of analog signals. Applies networking principles such as Ethernet and serial to communicate with a PLC. Expands on ladder logic using function blocks, user-defined data types (UDTs), and add-on instructions to program advanced control systems. Integrates PLCs with variable frequency drives (VFDs), analog/digital sensors, and encoders in real-world automation scenarios. Implements advanced HMI programming and introduces programmable safety relays for machine-level safety control. Includes hands-on labs and projects.	1- Program PLC ladder logic utilizing idustry based standards. 2- Utilize subroutines and interrupts in ladder logic programming. 3- Integrate analog I/O measurement and scaling using engineering units in an automation system. 4- Integrate PLCs with field-level devices using industrial communication protocols (e.g., Ethernet/IP, analog I/O) in localized automation systems. 5- Develop function blocks, add-on instructions, and user-defined data types (UDTs) for modular programming. 6- Interface PLCs with variable speed drives (VFDs), sensors, and encoders in automated control systems. 7- Implement advanced HMI programming techniques for operator interaction and diagnostics. 8- Apply programmable safety relays in the development of machine-level safety systems. 9- Troubleshoot complex industrial PLC applications using software tools and diagnostic methods.
MECH 2600	Introduction to Fluid Power Systems	Develops the concepts used to design, build, and control a fluid power system used in industrial automation. Covers the fundamental principles of fluid power, including actuators, valves, and system conditioning. Introduces measurement of key process variables such as pressure, flow, temperature, and level. Covers open-loop and closed-loop control using PID systems. Discusses basic instrumentation specifications, safety in classified areas, and process documentation using P&ID diagrams. Explores how modern process instruments communicate with control systems via	1- Explain fluid power theory, generation, and conditioning principles. 2- Describe fluid power control valves and actuator performance based on design requirements. 3- Apply measurement principles for process variables such as temperature, pressure, level, and flow. 4- Analyze open- and closed-loop control systems, including PID tuning concepts. 5- Interpret process and instrumentation diagrams (P&IDs) and associated symbols.

		analog signals and industrial communication protocols.	6- Integrate industrial instrumentation with control systems, addressing safety requirements and communication protocols (e.g., HART, Modbus).
MECH 2605	Introduction to Fluid Power Systems Lab	Applies the concepts used to design, build, and control a fluid power system that is used in an industrial automation process. Employs laboratory exercises to illustrate the selection and use of actuators, valves, and controls to sequentially control a process. Expands into process control instrumentation by integrating open-loop and closed-loop control (including PID) into fluid power projects using PLCs. Introduces basic calibration techniques, safety instrumentation, and communication methods such as HART and Modbus. Emphasizes P&ID interpretation and hands-on troubleshooting of process control elements.	1- Apply fluid power theory, generation, and conditioning principles in laboratory experiments. 2- Evaluate fluid power control valves and actuators based on performance design requirements. 3- Prepare industrial-quality documentation, including schematics, reports, and P&ID diagrams. 4- Integrate open- and closed-loop control systems, including PID loops, into PLC-controlled fluid power applications. 5- Interface process instruments with PLCs using analog signals and industrial communication protocols (e.g., HART, Modbus). 6- Validate industrial process instruments through calibration and troubleshooting.
MECH 2700	Industrial Motor Control Mechatronic Systems	Covers installation, troubleshooting, preventive maintenance, and theory on DC/AC motors, generators, and associated industrial control circuitry. Discusses ladder logic, controls, sensors, motor starters, overloads, and electronic devices used to control and protect DC/AC Machines. Describes three phase systems, transformers, and delta-wye connections. Introduces AC variable speed drives.	1- Describe DC and AC Motors and their associated control circuitry. 2- Describe three phase electrical power and transformers 3- Describe the use of ladder logic in industrial motor control 4- Describe sensing devices, timers, relays, solenoids, and starter in industrial motor control
MECH 2705	Industrial Motor Control Mechatronic Systems laboratory	Applies the principles of Installation, troubleshooting, preventive maintenance, and theory on DC/AC motors, generators, and associated industrial control circuitry. Uses ladder logic, controls, sensors, motor starters, overloads, and electronic devices used to control and protect DC/AC Machines. Lab activities include the wiring of transformers, and three phase systems in both delta and wye configurations.	1- Analyze the operation of DC and AC motors. 2- Create operationally correct logic and ladder diagrams. 3- Use sensing devices, timers, relays, solenoids, and starters to design industrial control circuitry. 4- Troubleshoot electrical motor control circuitry. 5- Analyze three phase electrical and transformer connections.
MECH 3220	Motion Control for Mechatronic Systems	Presents the selection and application of AC and DC servo motors and how to control the speed and position in automation	1- Design encoder, speed and position feedback in a servo motor application 2- Specify a variable frequency drive

		systems. Covers variable frequency drives and servo drives in automation system design. Applies algebra, trigonometry, integrals, and derivatives.	into an automation system 3- Design a transistor interface between a controller and a motor 4- Design the application of servo motors in a motion control application 5- Design the application of proportional/integral/derivative control of speed and position 6- Use algebra, trigonometry, and elementary calculus to solve applications of motor control
MECH 3225	Motion Control for Mechatronic Systems Laboratory	Applies the standards for the selection of AC and DC servo motors and the use of programming to control speed and position in automation systems. Implements variable frequency drives and servo drives in automation system design.	1- Use encoder, speed and position feedback in a servo motor application 2- Integrate a variable frequency drive into an automation system 3- Program pulse width modulation code using a transistor interface between a controller and a motor 4- Apply servo motors in a motion control application 5- Demonstrate the application of proportional/integral/derivative control of speed and position
MECH 3300	Industrial Networks	Covers the principles of designing, configuring, integrating, and maintaining an industrial network. Discusses the use of software to integrate PLCs, computers, managed switches, and smart devices into an industrial data network. Covers a broad spectrum from legacy networks to modern Ethernet based networks.	1- Describe the basic fundamental principles of computer networking 2- Define legacy industrial networks 3- Define modern industrial networks 4- Apply troubleshooting techniques used to maintain an industrial network
MECH 3305	Industrial Networks Laboratory	Applies the principles of designing, configuring, and integrating and maintaining an industrial network. Applies the use of software to integrate PLC's, computers, managed switches, and smart devices into an industrial data network.	1- Integrate industrial networks on industrial equipment 2- Manage industrial data 3- Specify an industrial network system 4- Install and integrate an industrial network 5- Troubleshoot and maintain an industrial network system
MECH 3400	Statics and Material Properties for Mechatronics	Teaches the concept of forces as vectors, the equations of equilibrium, calculation of internal forces, and the calculation of centroids and area moments of inertia. Teaches how to calculate tensile and shear stress in machine components and compare the resultant forces to standard theories of failure using the principles of statics. Teaches algebra, trigonometry, and	1- Resolve forces into vectors using vector math to calculate resultant forces on a structure. 2- Use 3 dimensional equations of equilibrium to characterize the forces on a structure. 3- Calculate the centroid and area moments of inertia. 4- Specify the yield and tensile strength

		elementary calculus in terms of the application of statics.	of a machine component 5- Resolve the forces on a machine and calculate the principle tensile and maximum shear stresses. 6- Compare the calculated stresses to standard theories of failure and develop a design factor of safety.
MECH 3405	Statics and Material Properties for Mechatronics Laboratory	Applies the concept of forces as vectors, the equations of equilibrium, calculation of internal forces, and the calculation of centroids and area moments of inertia. Covers how to calculate tensile and shear stress in machine components and compare the resultant forces to standard theories of failure by using the principles of statics.	1- Use vector math to calculate resultant forces on a structure. 2- Use three dimensional equations of equilibrium to characterize the forces on a structure. 3- Calculate the centroid and area moments of inertia for machine components. 4- Verify the yield and tensile strength of a machine component. 5- Use yield and tensile strength data in the design of a machine component. 6- Calculate the forces, principle tensile stresses, and maximum shear stresses on machine components. 7- Develop a design factor of safety using calculated stresses and standard theories of failure.
MECH 3500	Industrial Robots	Covers the principles of industrial robotics, programming, and the application of vision systems using industry created curriculum.	1- Define the design and operation of industrial robots. 2- Define common faults and how to recover from them. 3- Design programs for robotic operations 4- Explain the use of sensors to control the operation of an industrial robot in a manufacturing process. 5- Define the principles of vision in an industrial manufacturing process.
MECH 3505	Industrial Robots Laboratory	Applies the principles of industrial robotics, programming, and the application of vision systems using industrial robots.	1- Analyze the design and operation of industrial robots 2- Utilize a teach pendant to program and operate an industrial robot 3- Create, modify, and execute a robotic program 4- Use sensors to control the operation of an industrial robot 5- Interface an industrial robot with a vision system and a PLC
MECH 3570	Design Analysis and Rapid Prototyping	Covers the fundamentals of geometric dimensioning and tolerancing based on the	1- Demonstrate proficiency in the practice of GD&T as defined in ASME

		ASME Y14.5 standard. Explores how a design is affected by manufacturing tolerances and how to specify the fit of parts on a detail print. Emphasizes assembly analysis using SolidWorks Motion and rapid prototyping to verify the form, fit, and function of a design.	Y14.5. 2- Verify the performance of an assembly using SolidWorks Motion. 3- Manufacture parts in order to verify form, fit and function. 4- Create a unique design that can be manufactured. 5- Compose a variety of disciplinary-appropriate texts within multiple situations and for multiple audiences.
MECH 3700	CNC Machines in Mechatronic Design	Covers the application, programming, and maintenance of CNC machines. Emphasizes the integration of CNC machines into automation systems. Covers specifications, performance, interfacing with industrial robots, tooling, programming, and integrating the CNC machine into factory system.	1- Define the appropriate tooling according to workpiece and CNC machine requirements. 2- Define the steps to programming a CNC. 3- Define the software used to program a CNC. 4- Define how a CNC machine integrates with a factory system.
MECH 3705	CNC Machines in Mechatronic Design Laboratory	Applies the application, programming, and maintenance of CNC machines. Emphasizes the integration of CNC machines into automation systems. Applies specifications, performance, interfacing with industrial robots, tooling, programming, and integrating the CNC machine into a factory system.	1- Select the appropriate tooling according to workpiece and CNC machine requirements. 2- Program a CNC machine using simulation software and manually. 3- Program a CNC machine using software. 4- Integrate a CNC machine with a factory system.
MECH 4300	CAPSTONE I	Integrates the concepts of the Mechatronics Engineering Technology curriculum into a semester-long capstone proposal. Requires students to conceive, define, design, and document a capstone proposal.	1- Identify the selection of control devices for mechatronic systems. 2- Design a mechatronic system. 3- Calculate the performance of a mechatronic system. 4- Describe the techniques for troubleshooting a mechatronic system
MECH 4305	CAPSTONE I Laboratory	Integrates the concepts of the Mechatronics Engineering Technology curriculum into a semester-long capstone proposal. Requires students to prototype and test key components of their capstone proposal.	1- Select and use control devices in a mechatronic system. 2- Construct a mechatronic system. 3- Analyze the performance of a mechatronic system. 4- Troubleshoot the performance of a mechatronic system.
MECH 4400	Polymers/Composites and Processes	Teaches students the selection of polymers, design of polymer products and manufacturing processes associated with polymer based products. Also teaches types of composites and design of	1- Demonstrate a knowledge of manufacturing processes and equipment associated with producing composite and polymer products. 2- Recognize the properties of

		composite products.	industrial polymers and composite materials. 3- Design products using industrial plastics and composite materials. 4- Document the manufacturing processes associated with composite components.
MECH 4500	Advanced Automation Controls	Introduces methods of advanced control of high-speed components, analog controls, temperature, pressure, and time-delay processes using digital and analog control methods. Explores process-level automation, proportional–integral–derivative (PID) control, and remote feedback systems applied to industrial environments. Incorporates concepts of Supervisory Control and Data Acquisition (SCADA) systems, including architectures, communication protocols, and human–machine interface (HMI) integration to enhance process control and system monitoring. Includes advanced PID tuning techniques using industrial and simulation environments to analyze, tune, and optimize control loops. Applies algebra, trigonometry, and calculus to analyze and design complex automation systems. Laboratory applications are performed in MECH 4505	1- Analyze the use of an analog and digital PID controllers controller to control industrial processes. 2- Design and implement PLC-based controllers for time-delay and process-control applications. 3- Apply and compare PID tuning methods such as manual tuning, Ziegler–Nichols, and bump-test techniques using simulation and real-world systems. 4- Evaluate remote feedback control systems integrated with SCADA architectures for process monitoring and optimization. 5- Explain how SCADA and HMI systems support data acquisition, visualization, and control within industrial automation environments. 6- Apply Use algebra, trigonometry, and elementary calculus to solve advanced automation complex control problems.
MECH 4505	Advanced Automation Controls Laboratory	Implements methods of advanced control of high-speed components, analog controls, temperature, pressure, and time-delay processes using digital and analog methods of control. Applies practical applications of the concepts covered in the lecture portion of the class. Provides hands-on experience with programming, operation, and troubleshooting of Supervisory Control and Data Acquisition (SCADA) systems using modern power-system equipment. Students gain experience with SCADA architectures, communication protocols, data acquisition, and human–machine interfaces (HMIs). Students also implement and tune advanced PID controllers using industrial hardware and software	1- Use analog and digital PID controllers to control and optimize industrial processes. 2- Implement PLC-based controllers for time-delay and process-control systems, including PID algorithm integration. 3- Apply bump-test and Ziegler–Nichols tuning methods in industrial and simulated environments. 4- Integrate SCADA communication protocols (DNP3, Modbus, and IEC 61850) to enable data exchange between controllers and field devices. 5- Develop remote-site feedback control systems with SCADA for real-time monitoring, control, and data logging.

		simulations.	6- Create and configure HMIs to visualize and analyze process variables in a SCADA environment. 7- Troubleshoot SCADA and control-system communication issues using diagnostic and simulation tools.
MECH 4800	CAPSTONE II	Builds on Capstone I and integrates project management into a semester-long capstone project. Requires students to construct, validate, document, and present their capstone project.	1- Design a mechatronic project using the design skills learned in the Mechatronics Engineering Technology degree. 2- Demonstrate design project management skills. 3- Integrate design theory into the design of their team project. 4- Complete an industry standard design document of their team project. 5- Compose a variety of disciplinary-appropriate texts within multiple situations and for multiple audiences.