PATHWAY TO LEARNING ENGINEERING

Siemens mechatronics and the internet of things

A secondary or post-secondary school course featuring NX X Essentials and the TIA Portal

Technical content standards

Engineering design process

- Maintain an engineering notebook for research, prototype creation, documentation and daily reflections
- Apply engineering design and problem solving as an iterative process incorporating science, mathematics and engineering to optimally convert resources to meet a design solution
- Communicate design solutions using effective technical writing skills, including correct spelling, proper grammar and accurate technical vocabulary
- Prepare a quantitative plan for completing a project
- Assume leadership responsibility for collaborative team actions and decisions related to completing a project
- Evaluate the needs and costs of resources necessary for completing a project
- Prepare and communicate model documentation to include details like product analysis, size, materials, assembly details, schematics, program design, installation and service requirements

Designing for mechatronics

- Design, construct and operate a multi-axis robot for industrial applications
- Design and create wiring diagrams for controlling a robotic arm's motion
- Apply degrees of freedom to describe arm movement for programming the arm

- Integrate a robotic arm into an automated workcell for moving and manipulating components
- Design and create grippers and other end effectors for custom use in an automated setting
- Create a system using sensors to allow a robotic arm to make decisions based on sensor inputs
- Design a system integrating machines, machine tools, specialized dies, jigs, fixtures and instruments used in production to create parts to make jigs, fixtures, alignment and drill guides, gauges and other manufacturing and assembly tools with a rapid prototyping/additive manufacturing device
- Apply the principles of design for manufacturing, enabling the efficient and effective production of products
- Develop a logical argument for selecting the right automation to control tools, machines and the labor necessary to produce finished goods from raw materials
- Create a plan for protecting the safety, health and welfare of people engaged in the manufacturing environment
- Create technical drawings with proper dimensional tolerances and limits for components
- Use instruments accurately to make precise measurements to meet plan specifications, achieving the required dimensions, shapes, location of centers, parallel surfaces and other component attributes

- Understand and apply statistical process control (SPC) for quality control
- Research and apply knowledge of material properties to product design and development

Electrical and control systems

- Design and analyze an electrical system to efficiently convert, transform and transmit electricity to where it is needed
- Create, read and analyze schematics and provide a concise summary for documentation purposes
- Research and specify the electrical devices necessary to provide power
- Apply machine control systems, sensory feedback and information processing to increase efficiency
- Use flow charts and state diagrams to apply logic for designing control programs

Sensor logic and data

- Design a system using sensors to monitor changes and use that data to notify the system of changes
- Apply Boolean logic to design a system that monitors inputs
- Create programs to initialize, calibrate and monitor system parameters
- Select and apply appropriate sensors to obtain data about system performance
- Design a system of elements that manages power to accomplish a task involving defined movement
- Design a control system to vary a motor's speed and performance by using feedback from the system to be as efficient as possible
- Formulate a system to leverage and analyze data to maintain and improve product quality and ensure that product design requirements are satisfied
- Design and analyze machine control systems, sensory feedback and information processing to increase efficiency

Designing assembly systems

- Apply the engineering design of automation to assure alignment for assembly
- Create a management plan that includes quality planning, quality control, quality assurance and quality improvement for an advanced manufacturing environment
- Research, construct and evaluate a plan for an assembly line or workcell

Integrating computer numeric control (CNC)

- Apply Cartesian coordinates to create toolpaths for machine tools
- Research and apply proper cutting tool speeds, feeds and directions for manufacturing
- Create simple numeric control (NC) part programs using a text editor or a computer-aided manufacturing (CAM) package
- Analyze NC part program files to identify and correct errors
- Analyze part geometry to select appropriate cutting tools and fixturing devices to create a part using a CNC machine
- Edit the CNC machine program's tool library to establish tool offset values
- Design and prepare 3D models with appropriate units for generating toolpaths
- Set up a CAM package by editing the material and tool libraries
- Generate tool paths from a computer-aided design (CAD) program and edit NC part program files to identify and correct errors

Automation with programmable logic controllers (PLCs)

- Design and analyze an electrical system to efficiently convert, transform and transmit electricity to where it is needed
- Research and specify the electrical devices necessary to provide power
- Apply machine control systems, sensory feedback and information processing to increase productivity in manufacturing
- Use flow charts and diagrams to apply logic for designing control programs
- Design a system of elements that manages power to accomplish a task involving defined movement
- Design a control system to vary a motor's speed and performance by using feedback from the system to be as efficient as possible
- Formulate a system that collects and analyzes data to maintain and improve product quality and provide adequate confidence that the product satisfies design requirements

Human machine interface (HMI)

- Design visual displays to obtain and display data from a process controlled by a PLC
- Create a system to visualize and remotely control a workcell
- Create a communication system to monitor and automatically capture data on demand for storage in a database
- Design a system to remotely monitor and display real-time machine parameters for changing and updating operating parameters

Pneumatics design and control

- Construct systems that efficiently use a fluid (liquid or gas) under pressure to generate, transmit and control power
- Design an integrated system of machines, machine tools, jigs, fixtures, instruments and control programs to produce the required parts
- Research, construct and evaluate a plan for an assembly line or workcell
- Identify the systems, subsystems and typical components of an automated manufacturing operation
- Apply the necessary safety precautions associated with a fully automated system

Internet of things (IoT)

- Analyze various types of network setups to select the most appropriate for specific tasks
- Compare network operating systems to specify the most appropriate system for data networks
- Synthesize applications for use in gathering, analyzing and displaying data in information environments
- Design and implement a program for device security
- Evaluate various connectivity protocol options for communicating in the design stage of an automated workcell
- Secure the elements of an IoT-connected device

Business of manufacturing

- Research and categorize activities that a business conducts to make discoveries that can lead to developing new products or procedures or to improving existing products or procedures
- Research and evaluate new approaches for rapidly developing and deploying products that save time and are more efficient
- Review and evaluate a plan's benefits for an assembly line or workcell
- Create a strategy to increase efficiency and decrease waste by receiving inventory in time for the production process to reduce costs and the use of natural resources
- Create a management plan including quality planning, quality control, quality assurance and quality improvement for an advanced manufacturing environment
- Create a plan for protecting the health and safety of people engaged in a manufacturing environment

Career awareness and development

- Analyze the educational requirements, skills and abilities required for professionals in the referenced career fields
- Research the job outlook, demand for new employees and salary ranges for the referenced careers

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Europe
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For additional numbers, click here.

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