Advanced Manufacturing: Scope & Sequence

Year 1, Semester 1

AM101 Advanced Manufacturing I
(90 days) (47 Days Class, 43 Days Lab, 48% Lab)

District Pre-Assessment

Unit 1 (5 Days – 3 Class, 2 Lab)

Basic Safety/Tools/Fasteners: Demonstrate knowledge of safety, health, and environmental rules and regulations to avoid workplace injury and maximize machine productivity.

- Demonstrate knowledge of electrical safety standards and procedures to maintain industrial equipment safely.
- Demonstrate knowledge of safety practices of mechanical and fluid-controlled systems to maintain industrial equipment safely.
- Demonstrate knowledge of proper fall protection.
- Select appropriate Personal Protective Equipment (PPE) for various industrial safety situations.
- Describe how to appropriately use Personal Protective Equipment (PPE) for industrial safety situations.

CTSO Integration (Leadership Skills): SkillsUSA Officer Elections and Training
Professional Skills: 1. A-D, 4. A-F, 7. A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Industry Guest Speaker
Technical Standards: 2.1-2.6

Unit 2 (3 Days – 2 Class, 1 Lab)

Fundamentals of Industry 4.0

- Explain what Industry 4.0 is.
- Discuss how these changes impact the industry, current and future employees, and other members of the manufacturing value chain.
- Give examples of the benefits and value of Industry 4.0.
- Explain the 'interconnected world'.
- Define important terms, theories, and ideas behind Industry 4.0.

CTSO Integration (Leadership Skills): SkillsUSA Officer Elections and Training
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Journal Writing (Notebooks)
Technical Standards: 1.1-1.5

Unit 3 (5 Days - 3 Class, 2 Lab)

Precision Measurement
Demonstrate a solid understanding of the fundamentals of working with precision measurement instruments.

- Tape and Rule Measurement: Ability to precisely measure lengths, widths, and heights using various types of tapes and rules (e.g., steel rules, tape measures, folding rules).
- Proficiency in reading fractional, decimal, and metric scales accurately and interpreting measurements to the smallest graduation.
- Slide Caliper Measurement: Competence in measuring outside dimensions, inside dimensions, depths, and step dimensions using a slide caliper (vernier or digital).
- Gauge Measurement (e.g., Feeler Gauges, Radius Gauges, Thread Gauges) Proficiently using various types of gauges to determine if a part meets specified tolerances (Go/No-Go), measure gaps, clearances, or thread parameters.
- Angle Measurement (e.g., Protractor, Combination Square, Bevel Protractor) Competence in precisely measuring angles in various contexts, including internal, external, and compound angles.
- Micrometer Measurement: Mastered ability to measure outside dimensions, inside dimensions, and depths with exceptional accuracy and resolution (typically to 0.001 inch or 0.01 mm).
- Dial Gauge Measurement: Expertise in using dial gauges (or dial indicators) to measure small linear distances, runout, concentricity, flatness, and parallelism by comparing to a master or reference.

CTSO Integration (Leadership Skills): CTSO Meeting
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Aptitude and Interest Survey
Technical Standards: 3.7
Certifications: NC3 Precision Measurement

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Unit 4 (15 Days - 5 Class, 10 Lab)

Introduction to Mechatronics

- Identify the components of automated systems.
- Explain and demonstrate the functionality of Pneumatics, Electrical, and Mechanical components.
- Identify the elements of Programmable Logic Controllers.
- Analyze logic circuits and develop sequence programs.
- Apply the engineering design process to create automated systems and solutions.
- Apply critical thinking, problem-solving, and teamwork.
- Explain the function of electro-pneumatic systems.
- Explain and demonstrate the function of Stacking, Conveying, and Handling Systems.

CTSO Integration (Leadership Skills): SkillsUSA Framework
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Career-related Research
Technical Standards: 15.1, 15.3, 15.8, 15.9
Certification: NC3 Introduction to Mechatronics

Unit 5 (20 Days - 10 Class, 10 Lab)

Introduction to Mechanical Systems and Components

- Proper safety protocols are associated with performing work on mechanical systems.
- Explain gear reduction and install a belt or chain drive
- Explain the gear ratio and install a gear train
- Basics of robotics-related mechanical systems, including belts, gears, and chains
- Compute the advantage belt, chain drive, and gear train.
- Understanding of belt drives and their roles in industrial applications.
- Proper installation of belt drives and the importance of following specific protocols.
- Identification of the main components of the belt drive systems in industrial installations.
- Understanding of chain drives and their roles in industrial applications.
- Proper installation of chain drives and the importance of following specific protocols. Identification of the main components of chain drive systems in industrial installations.
- Understanding of gear drives and their roles in industrial applications.
- Proper installation of gear drives and the importance of following specific protocols.
- Identification of the main components of gear drive systems in industrial installations.

CTSO Integration (Leadership Skills): Fall Conference
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Resume Writing
Technical Standards: 9.1-9.8; 10.1-10.7
Certification: NC3 Fundamentals of Mechanical Systems

Unit 6 (20 Days - 15 Class, 5 Lab)

Basics of Electrical Systems in Manufacturing

- Explain the working principles of an electrical circuit.
- Apply Ohm's Law and Kirchhoff's Law, using digital multimeters, interpreting series/parallel circuits, and assessing power/circuit protection.
- Safely and effectively measure an electrical circuit.
- Identify, sketch, and describe basic electrical components and devices.
- Build, test & troubleshoot basic electrical circuits.
- Read electrical drawings (i.e., simple starter circuits, PLC output, etc.)
- Calculate impedance and inductive/capacitive reactance.
- Measure and determine voltage, current, resistance, and power in AC and DC circuits (i.e., oscilloscope, volt/ohm, meter, etc.)
- Troubleshooting various complex AC circuits with faults using a voltmeter and ohmmeter.
- Troubleshooting various complex DC circuits with faults using a voltmeter and ohmmeter.

CTSO Integration (Leadership Skills): Rnd 1 Mock Interview
Rnd 1 Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Mock Interviews
Technical Standards: 4.1-4.11, 6.1-6.8
Certifications: NC3 Fundamentals of Electricity
AC & DC

Unit 7 (12 Days - 5 Class, 7 Lab)

Fundamentals of Industrial Robotics

- Robotic safety review
- Basics of robotic systems, including design, operation, and applications.
- Overview of robotic technologies impacting business and manufacturing.
- Identify and explain the design and function of various types of robotic systems.
- Safely operate and maintain robotic systems.
- Program various robotic systems.
- Commission and teach robotic programs and positions.
- Understand and define control instructions.
- Troubleshoot and diagnose robotic systems.
- Optimize robot paths and movement.
- Understand network and communication protocols.

CTSO Integration (Leadership Skills): SkillsUSA Meeting

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Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Mock Interview
Technical Standards: 12.1-12.6, 15.1-15.9, 16.1-16.6
Certifications - Universal Robots EDU Certification, NC3 Festo Fundamentals of Robotics

Unit 8 (10 Days - 4 Class, 6 Lab)

Drafting in Manufacturing

- Basics of drafting and schematics
- Creating CAD representations for sketches
- Create dimensional CAD drawings (2D and 3D)
- Interpret Electrical Drawings and architectural plans

CTSO Integration (Leadership Skills): Guest Speaker
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Presentation Skills
Technical Standards: 3.1-3.9, 11.1-11.6
Certification: OnShape

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Year 1, Semester 2

AM102 Advanced Manufacturing II
(90 days) (40 Days Class, 50 Days Lab, 56% lab)

Unit 9 (20 Days – 10 Class, 10 Lab)

Level 2: Applied Mechanical Systems:

- Familiarization with mechanical drives and their roles in industrial applications.
- Proper installation of different types of mechanical drives and the importance of following specific protocols.
- Identification of the main components of the mechanical drive systems in industrial installations.
- Familiarization with ball screws and linear ball bearings.
- Installation of ball screws and linear bearings and how they are used in linear guide assemblies.
- Have learned what backlash is, concerning ball screws, and how to minimize or eliminate it.
- Pitch, lead, and start of a ball screw, and know how to determine and calculate these parameters.
- Familiarization with the relationship between the pitch, lead, and start of a ball screw, as well as their effects on the ball screw speed.
- Familiarization with the basic principles of shaft alignment in applications requiring the coupling of two machines.
- Learn how to perform shaft alignment using the straightedge and feeler gauge, rim and face, reverse dial indicator, and laser (optional) methods.
- Identify characteristics and typical applications of the following coupling types: flange, flexible sleeve, chain, gear, grid, and universal joint couplings.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Regionals Prep
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Simulated Lab Experience
Technical Standards: 10.1-10.7
Certification: NC3 Level 2 Applied Mechanical Systems

Unit 10 (10 Days – 5 Class, 5 Lab

Fundamentals of Pneumatic Systems

- Demonstrate safety standards and best practices, adhering to safety protocols in pneumatic systems
- Interpret and draw pneumatic symbols
- Identify components of a pneumatic system.
- Utilize circuit simulation software to design, test, and optimize circuits.
- Understand the principles and applications of vacuum systems.
- Construct and troubleshoot pneumatic circuits.
- Understand the practical application of Pascal's and Boyle's law.
- Explain and understand the conditioning and distribution of air.
- Determine the root cause of component failure.
- Make speed adjustments to actuators.
- Explain the force/pressure/area relationship.
- Describe the different states an actuator can assume and the importance of each.
- Utilize simulation software to demonstrate basic diagnostic principles.
- Identify/explain the function of pneumatic components.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Prepare for Regional Competition
Professional Skills: 3.A-E, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 7.RP.A.3, 6.EE.A.2
Work-based Learning: SkillsUSA Regional Competition
Technical Standards: 7.1-7.10
Certifications: NC3 Fundamentals of Fluid Power -Pneumatics

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Unit 12 (15 Days – 5 Class, 10 Lab

Fundamentals of Hydraulic Systems

- Design, assemble, test, and troubleshoot basic hydraulic circuits. Identify and describe the construction, design features, and operation of hydraulic components.
- Interpret technical specifications and data relating to hydraulic components and systems.
- Identify and explain graphical symbols for hydraulic components.
- Describe the fundamentals of oil flow.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Regional Competition
Professional Skills: 3.A-E, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 7.RP.A.3, 6.EE.A.2
Work-based Learning: Mock Interview, Guest Speaker
Technical Standards: 7.1-7.10
Certifications: NC3 Fundamentals of Fluid Power - Hydraulic

Unit 13 (15 Days - 5 Class, 10 Lab)

Level 2: Applied Industrial Motor Controls:

- Apply safety principles about industrial control components and circuits.
- Read and interpret technical documents about industrial control components and circuits.
- Explain fundamental theories related to industrial control components and circuits.
- Demonstrate safe practices and procedures when working with industrial motor controls.
- Describe principles and operations related to industrial motor and control circuits.
- Evaluate industrial motor control circuit performance and apply appropriate troubleshooting techniques.
- Interpret and use wiring diagrams, symbols, and schematics to troubleshoot industrial motor control circuits.
- Demonstrate and describe the use of relays, contactors, motor starters, and pilot devices in motor control circuits
- Set up, adjust, configure, program, interface, monitor, and operate smart factory systems that use Industry 4.0 technology to efficiently produce high-quality products in these applications as an integrated system
- Describe pick and place, gauging, indexing, sorting and queuing, and robotic assembly.
- Explain the components used including: DC-motor belt conveyors, ball screw linear drives, electro-pneumatic actuators/valves, vacuum parts pickup, vacuum switches, electronic sensors, clutch, stepper motors, and servo robots.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Fall Leadership Conference
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4
Work-based Learning: Industry Site Visit
Technical Standards: 1.1-1.5, 13.1-13.5, 15.1-15.9
Certification: NC3 Level 2 Electrical: Applied Motor Controls

Unit 14 (30 Days - 15 Class, 15 Lab)

Introduction to Semiconductor Cleanroom Technology:

- Explain the importance of cleanrooms in manufacturing in the semiconductor and pharmaceutical industries
- Describe cleanroom classifications and standards
- Identify and demonstrate proper cleanroom attire and protocols
- Simulate cleanroom operations including air flow control, particle monitoring, and environmental controls.
- Explain the impact of cleanroom environments on manufacturing processes and product quality.
- Develop and implement a cleanroom maintenance and monitoring plan

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Fall Leadership Conference, Regionals Prep
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Guest Speaker
Technical Standards: 5.1-5.10, 16.1-16.6, 2.1-2.6

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Year 2, Semester 1

AM201 Advanced Manufacturing III
(90 days) (44 Days Class, 46 Days Lab, 51% lab)

Unit 1 (7 Days - 2 Class, 5 Lab)

Fundamentals of Sensors (Level 1)

- Understand and explain the fundamentals of sensor technology.
- Recognize sensor functionality and select the appropriate sensor for various industrial applications
- Interpret the language, symbology, and protocols commonly used in the sensor field
- Explain how the various types of sensors work and function – Make electrical connections and test the sensor for proper operation
- Troubleshoot, repair/replace a faulty sensor
- Configuration and function of the sensors used
- Basic principles of connection and circuit technology – Configuration of logic circuits
- Selection of appropriate sensors by considering specific parameters
- Signal processing and filtering
- Calibration and maintenance of sensors

CTSO Integration (Leadership Skills): SkillsUSA Meeting
Professional Skills: 1.A-D, 4.A-F, 7.A-C
Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.SL.4, ELA.11-12.L.4, 5.NF.B.3, 5.NF.B.6, 5.NF.B.7
Work-based Learning: Manufacturing Field Trip
Technical Standards: 14.1-14.7
Certifications - NC3 Festo PLC Sensors 1

Unit 2 (10 Days -5 Class, 5 Lab)

Level 1: Fundamentals of PLC's Allen-Bradley/Siemens

- Explain the operation and design of various relays
- State/explain the three PLC sections
- State/explain the three types of input devices
- State/explain the types of memory in a PLC
- Explain the different types of PLC addressing
- State/explain the three types of output devices
- Convert different numbering systems used in a PLC
- Explain various Boolean gates/truth tables
- Demonstrate how to use a PLC for troubleshooting to resolve problems quickly
- Understand and apply communication protocols
- Integrate and configure HMIs

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4,
Work-based Learning: Resume, Mock Interview
Technical Standards: 8.1-8.6, 14.1-14.7

Certifications: NC3 Level 1 Fundamentals of PLCs

Unit 3 (10 Days - 5 Class, 5 Lab)

PLC Technology II: Allen-Bradley or Siemens (Level 2)

- Program a PLC using ladder logic.
- Upload and download programs to/from a PLC.
- Understand and program basic PLC functions.
- Modify a current PLC program.
- Program HMI Applications.
- Understand and explain basic networking fundamentals.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Prep for Fall Leadership Conference
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Guest Speaker
Technical Standards: 8.1-8.6, 13.1-13.5
Certifications: NC3 Level II PLC Allen-Bradley/Siemens

Unit 4 (10 Days - 5 Class, 5 Lab)

Applied Principles of Smart Sensors

- Gain an understanding of what Industry 4.0 is and how smart sensors are an important part of implementing Industry 4.0
- Be familiar with the main differences between smart sensors and regular sensors, and what advantages they offer over regular sensors.
- Gain an understanding of the principles of operation of the most common sensor types: inductive proximity sensors, photoelectric sensors, ultrasonic sensors, process sensors, RFID read/write devices, and barcode readers.
- Be familiar with the communication protocols used to communicate with smart sensors, such as IO-Link and Profinet

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Guest Speaker
Technical Standards: 14.1-14.7
Certifications: NC3 Applied Principles of Smart Sensors

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Unit 5 (13 Days – 6 Class, 7 Lab)

Applied Robotic Systems and Data Communication Systems:

- Describe robotics operating systems
- Identify the problem and develop a flowchart for software development
- Identify the peripheral hardware required to complete the task
- Develop or reuse software components
- Use software tools to create robotic applications
- Use a simulation to develop and validate a design for a robotic problem
- Use a test drive development approach
- Demonstrate a methodical approach to process development
- Describe integration technologies
- Describe robotics project constraints
- Select data communication protocols and associated connectors
- Identify tradeoffs among wired and wireless data communication protocols
- Explain IoT and IIoT

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Fall Leadership Conference
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Field Trip
Technical Standards: 12.1-12.6, 15.1-15.9
Certification: NC3 Applied Robotics, Universal Robots, FANUC Robot, and KUKA Robot

Unit 6 (15 Days – 6 Class, 9 Lab)

Fluid Power Pneumatic and Vacuum Systems(Level 2)

- Set up and commission complex pneumatic systems.
- Systematically troubleshoot pneumatic systems.
- Know the role of PLC in automation and how to integrate the PLC into the control section.
- Work with valve terminals.
- Interpret the latest standards and regulations.
- Understand and explain the generation and provision of a vacuum
- Able to describe the fundamentals of vacuum
- Select and dimensions of suction cups
- Interpret the material properties of handling with a vacuum
- Interpret the vacuum generator properties
- Design simple vacuum circuits

CTSO Integration (Leadership Skills): Fall Leadership Conference Prep
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Project Development
Technical Standards: 7.1-7.10, 8.1-8.6
Certification: NC3 Applied Fluid Power

Unit 7 (10 Days - 6 Class, 4 Lab)

Smart Manufacturing Systems

- Demonstrate understanding of industrial automation systems and their role in modern manufacturing.
- Interpret and apply principles of Statistical Process Control (SPC) to monitor and improve production processes.
- Analyze data to identify trends, anomalies, and potential process improvements using SPC tools.
- Program and troubleshoot programmable logic controllers (PLCs) for basic automation tasks.
- Integrate AI concepts to enhance automation and predictive maintenance systems.
- Collect, interpret, and visualize real-time production data using industrial IoT and AI-based analytics platforms.
- Demonstrate safe and ethical practices when working with automated systems and AI in industrial settings.
- Define MES(Manufacturing Execution System) and related functionality.
- Configuration of MES.
- Incorporate HMI applications into a production system.
- Utilize web services/email push delivery.
- Explain the importance of data security.
- Explain how 3D Modeling of systems impacts production systems.

CTSO Integration (Leadership Skills): Fall Leadership Conference

Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Field Trip
Technical Standards: 1.1, 1.5, 16.1-16.6
Certification: NC3 Applied Industry 4.0

Unit 8 (5 Days - 2 Class, 3 Lab)

Smart Product Tracking & Labeling

- Choose the best Product ID device for various applications
- Determine inspection goals
- Estimate the inspection time
- Identify features or defects
- Define various methods of product identification
- Identify and explain the function of various elements of product identification

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- Explain Radio frequencies: LF, HF, UHF, and SHF Systems
- Identify various barcode types
- Describe Symbology and Standards

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Simulated Lab Experience
Technical Standards: 1.1-1.5
Certification: NC3 Applied Product ID Fundamentals

Unit 9 (10 Days - 5 Class, 5 Lab)

Assembly Packaging Manufacturing

- Demonstrate understanding of manufacturing processes and the role of assembly and packaging in the production cycle.
- Safely operate tools, equipment, and machinery commonly used in assembly and packaging environments.
- Assemble components using manual and automated methods according to production specifications.
- Apply quality control techniques to ensure assembled and packaged products meet defined standards.
- Understand and follow packaging requirements based on product type, transportation needs, and sustainability guidelines.
  Work collaboratively in a manufacturing team using lean production and workplace organization principles (e.g., 5S, Kaizen).
- Document and track production activities using basic inventory and process logging systems.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Fall Leadership Conference, Regionals Prep
Professional Skills: 2.A-C, 4.A-F
Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Guest Speaker
Technical Standards: 1.1-1.5, 15.1-15.9

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Year 2, Semester 2

AM202 Advanced Manufacturing IV
(90 days) (30 Days Class, 60 Days Lab, 67% lab)

Unit 10 (90 Days - 30 Class, 60 Lab)

Intermediate Semiconductor Cleanroom:

- Explain the importance of cleanrooms in manufacturing in the semiconductor and pharmaceutical industries
- Explain the impact of cleanroom environments on manufacturing processes and product quality.
- Develop and implement a cleanroom maintenance and monitoring plan
- Understand the basics of silicon and wafer fabrication, including the role of transistors and silicon in manufacturing.
- Follow cleanroom practices such as proper gowning, degowning, wafer handling, and contamination control, adhering to safety protocols.
- Demonstrate knowledge of photolithography and the spin/coat/bake process, along with maintenance of relevant equipment.
- Gain proficiency in pattern generation, optical inspection, and the use of microscopes in wafer fabrication.
- Understand plasma etching methods and equipment, and perform visual checks of plasma processes.
- Demonstrate knowledge of removing photoresist layers and conducting wet and dry wafer cleaning procedures.
- Recognize plasma deposition equipment and troubleshoot common issues in wafer fabrication.
- Use metrology tools for wafer inspection, including SEM, film thickness monitors, and profilometers, to detect defects and ensure uniformity.
- Understand the polishing and surface cleaning processes, along with the maintenance of relevant equipment.
- Explain the bonding process in wafer manufacturing, including wafer-to-carrier and device-to-device bonding techniques.
- Demonstrate knowledge of debonding methods to safely remove sensitive wafers from carriers.
- Understand and perform electrical wafer probing, including robotic probing and wire probing techniques.

CTSO Integration (Leadership Skills): SkillsUSA Chapter Meetings, Fundraiser, Prepare Spring SkillsUSA Leadership Conference
Professional Skills: 2.A-C, 4.A-F

Academic Standards: ELA.11-12.W.4, ELA.11-12.SL.4, ELA.11-12.L.4
Work-based Learning: Industry Guest Speaker, Field Trip, Simulated Lab Experience
Technical Standards: 4.1-4.11, 5.1-1.10
Common AZCCR Math Standards (CAMS)
English Language Art Standards (ELAS)
The National Coalition of Certification Center (NC3)
Certifications: ROOTS EDU Cleanroom

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