



AERO-FLEX

PRE-APPRENTICESHIP

TRAINING PLAN SUPPLEMENT - JULY 2017

The Aero-Flex Unilateral Apprenticeship Committee has created a flexible model for implementing an Engineering Pre-Apprenticeship for Advanced Manufacturing.





TRAINING PLAN SUPPLEMENT

INTRODUCTION

The Aero-Flex Unilateral Apprenticeship Committee (A-F UAC) was formed to develop an employer-driven pre-apprenticeship framework that would meet the workforce development needs common to its industry partners, and to provide a customized layer within the framework to allow each employer to design (*flex*) its own program, meeting not only needs of industry but of each participating manufacturer.

Aero-Flex Pre-Apprenticeship Curriculum

The training plan described herein includes the following components:

- **Assessment**



- Each Pre-Apprentice may take the applicable online training needs assessment geared towards the Pre-Apprenticeship Curriculum.
 - Credit for prior learning may be provided, should the participant demonstrate competency in an area of the assessment.

- **Track I - Employability – Work Readiness Skills**

- This core set of skills will prepare the pre-apprentice for the work environment.
- Training will be provided in a combination of in-person and online training and will be delivered at the high school, junior college, employer site and/or Workforce Investment Board.

- **Track II – Industry-Specific Occupational Skills**



- Each employer may determine which set of pre-defined competencies they want to include in their pre-apprenticeship or if they want to custom-select this flexible component of the curriculum.
- Training may be delivered online or in a blended learning approach depending upon the competency or competencies selected by the employer.

- **Track III – Work-Based Learning (OJT)**



- Each employer will provide the work-based learning experience, or on-the-job-training component.
 - This may include project work, job shadowing and other activities as deemed appropriate by the employer.

HIGHLIGHTS OF PRE-APPRENTICESHIP

- Explore and learn about exciting careers
- Benefit from classroom, online and hands-on training
- Get a start on career-specific training with viable career pathway opportunities
- Build work-readiness skills employers desire
- Receive industry-recognized credentials
- Free membership to Society of Manufacturing Engineers
- May include paid work experience
- Opportunity to advance into a Registered Apprenticeship

An Employer Centric Earn and Learn Model

- **Credential Attainment**

- **Track I** - At the completion of Track I the participant will receive a Blueprint for Workplace Success Certification from the South Bay Workforce Investment Board.
- **Track II** - At the completion of Track II the participant will receive a Certificate(s) of Completion from the Tooling U-SME
- **Track III** – At the completion of Track III the employer may choose to provide its own completion certificate for the internship/work-based learning component of the program
- **A capstone Pre-Apprenticeship program completion Certificate** may be obtained if the participant completes all facets of the training plan. This Certificate will come from the UAC member companies via the SBWIB.
- These certificates and certifications are industry-recognized as demonstrated by the confirmation from UAC members and are stackable and portable within the advanced manufacturing sector.

Training Plan – Track I – Employability – Work Readiness Skills

- I. Blueprint I (approximately 30 hours) and Blueprint II (approximately 20 hours) of in-person and online training covering the following Skill Domains and Competencies (detailed course titles and descriptions are available in the Appendix herein):
 - a. Personal Skills
 - i. Integrity
 - ii. Initiative / Dependability & Reliability
 - iii. Professionalism & Adaptability
 - b. People Skills
 - i. Teamwork
 - ii. Communication
 - iii. Respect
 - c. Applied Knowledge
 - i. Job Seeking Skills
 - ii. Reading
 - iii. Writing
 - iv. Mathematics
 - v. Technology
 - vi. Critical Thinking
 - d. Workplace Skills
 - i. Planning & Organizing
 - ii. Problem Solving
 - iii. Decision Making
 - iv. Customer Focus

Training Plan – Track II – Industry-Specific Occupational Skills

- I. Each UAC member Employer can determine which set of Skills and Competencies are of highest priority for their program. The employer can flex this part of the curriculum to determine if all competencies should be included in their program or if they want to select 1 or more skill areas to be included

- II. Up to 48 hours of training are available in a blended learning approach, depending on how many competencies the employer selects, in the following Skill Domains and Competencies (detailed course titles and descriptions are available in the Appendix herein):
 - a. Health & Safety (3 online courses, 4.5 hours)
 - i. Safety
 - b. Applied Technologies (11 online courses, 16.5 hours)
 - i. Electronics
 - ii. Engineering Technology
 - iii. Fluids
 - c. Engineering Drawings & Prints (11 online courses, 16.5 hours)
 - i. Applied Mathematics
 - ii. Print Reading
 - iii. Drafting/Drawing/Modeling
 - iv. Metallurgy
 - d. Measuring & Improving Work (6 online courses, 9 hours)
 - i. Quality Assurance Programs
 - ii. Continuous Process Improvement
 - iii. Lean Principles
 - iv. Project/Program Management
 - e. Custom Bundle
 - i. Employer can choose from these courses and create a company-specific bundle courses and may elect to deliver some of these topics internally in which case the course outlines will be reviewed for inclusion in certificate

Training Plan – Track III – Work-Based Learning/OJT/Internship

- I. Approximately 6 to 12 weeks (or more) of work-based learning/on-the-job training provided by UAC member Employers
- II. Training will be employer-driven and based on project work or assignments at their discretion
- III. At the completion of this training component the Employer will provide written confirmation of completion of work-based learning period and hours worked (form and manner in development)



CURRICULUM APPENDIX

TRACK I – EMPLOYABILITY – WORKPLACE SKILLS

PERSONAL SKILLS

Competency	Course	Description
Integrity	Keeping Your Job (Blueprint I)	Employees are expected to be business-like and dependable. This course focuses on how to evaluate and take responsibility for work completion, meet expected standards and performance, take initiative, consider choices and options, consider how your decisions and behavior impact yourself and others, follow company policies and guidelines, know how and when to ask for help and how to get along with others, not conduct personal business on company time, and decide which of your choices brings you closest to what you want most out of the situation.
	Teamwork Like Clockwork, Leadership Like Stewardship (Blueprint II)	Teamwork allows a company to use the collective knowledge, skills and abilities of its employees to the fullest in order to grow its business and increase profits. This course focuses on the benefits of teamwork including greater efficiency, increased productivity and performance, enhanced creativity, unity, and improved workplace relationships.
Initiative/ Dependability & Reliability	Managing Your Time Effectively (Blueprint I)	It is important to organize and manage your time effectively. This courses focuses on how organizing and managing your time increases productivity, provides greater control over your time, decreases stress, overcomes procrastination, saves time and company money, allows you to meet your deadlines, and is a tool to manage multiple tasks to leave work on time.
	Teamwork and Leadership; Critical Thinking and Problem Solving (Blueprint II)	Leadership ability is demonstrated by exhibiting behaviors such as being enthusiastic about the work you do, doing it well, and accepting assignments that expand your knowledge and skills. Leadership is also demonstrated by the commitment you display towards your work and to the company, by working hard, and by displaying the discipline to follow through with assigned work. Strategies include be strong, objective, flexible, supportive, generous, positive, inquisitive, a problem solver, a motivator, a builder, and a clear communicator. This course focuses on why critical thinking is important, the importance of problem solving, the benefits of problem solving to the employer and the employee, and how asking questions is the beginning of critical thinking.
Professionalism & Adaptability	Managing Your Time Effectively (Blueprint I)	It is important to organize and manage your time effectively. This courses focuses on how organizing and managing your time increases productivity, provides greater control over your time, decreases stress, overcomes procrastination, saves time and company money, allows you to meet your deadlines, and is a tool to manage multiple tasks to leave work on time.
	Working with Cultural Diversity (Blueprint II)	Embracing cultural diversity is also inclusive and fosters an environment of openness and acceptance which is positive for employee morale, productivity, and performance. This courses focuses on how employees can use the differences represented by their coworkers as an opportunity to learn about different cultures, thus expanding their knowledge, education, and cultural awareness.
	The Latitude of Your Attitude (Blueprint II)	This workshop focuses on attitude, an important workplace behavior that is the underlying basis for success in the workplace. This course reviews strategies to improve attitude, and how attitude affects conduct, as well as recognize the rewards for positive behavior and the consequences of negative behavior.
	Great Expectations and the Sensibility of Flexibility (Blueprint II)	Expectations and the necessity of remaining flexible in the workplace, despite setbacks and disappointments, are important. This course teaches what it takes to go above and beyond, as well as how being flexible pays off for positive career advancement. Flexibility could entail taking extra work, assisting a co-worker, taking initiative, and striving to do high quality work.

	Developing Workplace Savvy or the Price of Not Paying Attention (Blueprint II)	Understanding workplace culture, and fitting into the environment in which the company operates and knowing how to relate to coworkers and supervisors is critical for success in the workplace. This workshop provides the True Colors/Inner Heroes Assessments for insight into how the personality traits and characteristics can guide them in choosing a company or workplace that is a good fit for them.
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PEOPLE SKILLS

Competency	Course	Description
Teamwork	Teamwork Like Clockwork; Leadership Like Stewardship (Blueprint II)	Teamwork allows a company to use the collective knowledge, skills and abilities of its employees to the fullest in order to grow its business and increase profits. Learn the benefits of Teamwork in the workplace including greater efficiency, increased productivity and performance, enhanced creativity, unity and improved workplace relationships.
Communication	Using Effective Communication (Blueprint I)	This course teaches that effective communication involves listening to customers, responding professionally and adequately, taking initiative to provide assistance, being solution oriented, providing exceptional service and thorough follow-up with a great attitude, completing tasks well to increase opportunities of advancement, being willing to get along and work well with others, and using appropriate language, etiquette, and behavior.
	Lend Me Your Ears (Blueprint II)	This course teaches the behavior and requirements of active listening such as eye contact, understanding by asking questions, paraphrasing back to the speaker, asking for clarification, understanding and following orders, taking directions from supervisor, participating in meetings and communicating with customers and clients effectively.
	Speak Well or Sit Down (Blueprint II)	Effective speech is used to verify instructions, to ask or answer question properly, to give accurate instructions, and to professionally communicate with supervisors, customers, clients and co-workers. Effective speech creates a professional and pleasant atmosphere and it cuts down on mistakes thereby increasing productivity. This course focuses on the importance of effective speech, having control over our words, and the use of good manners in the workplace.
	Difficult by Design and When Tempers Collide (Blueprint II)	Difficult people can slow down productivity, waste time and resources and negatively impact workers. This course teaches strategies to manage conflict by not taking words personally, asking questions rather than make statements, listening actively, separating the issue from the individual, and not becoming emotionally involved. Conflict can be managed by taking a deep breath, walking away from conflict, managing emotions, using humor and seeking assistance. Benefits of managing workplace conflict effectively include improved workplace relationships, a less stressful environment, great productivity and possible promotion or recognition.
	"Heinz 57" or the Recipe for Diversity (Blueprint II)	This course identifies the importance of understanding what diversity means and the benefits of working with a culturally diverse environment. The benefits include ability to interact with global customers, learn new points of view, learn to communicate and respond to customers from diverse backgrounds, draw on talents and ideas of diverse workers, increase customer base, and expand knowledge about other cultures, races and religions.
Respect	Conflict Management (Blueprint I)	Learn the causes and effects of conflict that include the pressure to be competitive, doing more with less, gaining more customers, increasing profits, declining in productivity, and increasing in mistakes and tension in the environment. Learn the strategies to deal with difficult people such as keeping calm, not overreacting, thinking before you speak, remaining objective, keeping perspective, and choosing not to play.

APPLIED KNOWLEDGE

Competency	Course	Description
Job Seeking Skills	Contacting Employers (Blueprint I)	This lesson introduces the participants to the important steps of the job search process that includes finding the right employer, contacting employers in-person, completing a job application, preparing a resume, writing a cover letter, and keeping a record of your job search efforts. Learn to set goals, build a network, research career exploration and how to communicate with employers. Review tips on how to approach employers in-person, be conscious of attire and how and what you communicate, show enthusiasm, and use productive ways to follow-up an in-person visit.
Reading	Workplace Skills for Today's Employee (Blueprint I)	Understanding basic reading competencies in the workplace including understanding e-mails, memos, documenting phone messages, and interpreting written employee information.
Writing	Active Writing (Blueprint I)	Use active writing to communicate effectively when writing emails, memos, reports, instructions, and communicating with customers and staff. Understand the importance of using proper grammar, punctuation, spelling, a time care and personnel documents.
	Write Right and Re-Write (Blueprint II)	It is important to write effectively in the workplace. Learn strategies such as being clear, accurate, precise, brief and knowing what is appropriate. Clear thinking and clear writing allows you to get your point across in a convincing way.
Mathematics	Financial Literacy Module (Blueprint I)	Learn how to create and manage a budget, count money and make change, keep basic financial records, make responsible expenditures, and use banking services. The course teaches the importance of using adding machines and basic computations to calculate income and handling valuable resources, equipment, time cards, and cash appropriately. Learn how to apply daily competencies using resources, effective interpersonal skills, acquiring and evaluating information, monitoring, technology, and budgeting.
Technology	Workplace Skills for Today's Employee (Blueprint I)	It is crucial for today's employee to understand how to utilize technology to research and gather information and share it with others. This course teaches the importance of using computers, applying technology to tasks, maintaining and troubleshooting equipment, and upgrading software.
Critical Thinking	Critical Thinking & Problem Solving (Blueprint II)	Understand what actions to take when problems arise by using critical thinking. Use critical thinking to make informed decisions, ask questions, obtain facts and truth, listen, read to understand, observe critically, cooperate with others, and learn to follow policies and procedures.

WORKPLACE SKILLS

Competency	Course	Description
Planning & Organizing	Devise and Organize (Blueprint II)	Effective time management and effective organizational skills are important tools in the workplace. Learn how organizing and managing your time increases productivity, provides greater control over your time, decreases stress, helps overcome procrastination, saves time and company money, and allows you to meet your deadlines and manage multiple tasks to leave work on time.
Problem Solving	Critical Thinking & Problem Solving (Blueprint II)	Understand what actions to take when problems arise, take initiative to solve problems, learn and follow guidelines and procedures, how to access resources and information to solve problems, seek help when negative situations occur, and use common sense.
Decision Making	Decision Making Methods (Blueprint I)	Employees are expected to be business-like and dependable, evaluate and take responsibility for work completion, meet expected standards and

		performance, take initiative, consider choices and options, consider how your decisions and behavior impact yourself and others, follow company policies and guidelines, know how and when to ask for help and how to get along with others, and decide which of your choices brings you closest to what you want most out of the situation.
Customer Focus	Using Effective Communication (Blueprint I)	This course teaches that effective communication involves listening to customers, responding professionally and adequately, taking initiative to provide assistance, being solution oriented, providing exceptional service and thorough follow-up with a great attitude, completing tasks well to increase opportunities of advancement, being willing to get along and work well with others, and using appropriate language, etiquette, and behavior.

TRACK II – INDUSTRY-SPECIFIC OCCUPATIONAL SKILLS HEALTH & SAFETY

Competency	Course	Description
Safety	Intro to OSHA 101	"Intro to OSHA" provides an introduction to the purpose of OSHA and how its standards and guidelines affect employers and employees. Most U.S. workplaces are covered by OSHA, and its existence has greatly improved workplace safety. Some industries are not covered by OSHA, however, and some states have safety programs that take the place of OSHA. OSHA standards are enforceable by law. Compliance with OSHA standards is enforced by inspections and record keeping, which have specific steps and requirements. Employers and employees have different rights and responsibilities regarding OSHA standards.
	Ergonomics 102	The class "Ergonomics" provides an overview of the science of ergonomics and its application in the workplace. Ergonomic hazards may be present in any work environment, and are a common safety risk. Not all ergonomic risks are apparent, but they can still cause musculoskeletal disorders (MSDs). Vibration, poor posture or positioning, and repetitive motion are common ergonomic hazards, though back injuries are the most common workplace injuries. The majority of work-related back injuries are caused by unsafe lifting techniques. Even computer tasks can cause MSDs over time. Ergonomic solutions should be tailored to the individual employee performing the job or task.
	Personal Protective Equipment 111	The class "Personal Protective Equipment" introduces the purpose and uses of personal protective equipment (PPE). As defined by the Occupational Safety and Health Administration (OSHA), PPE minimizes exposure to hazards and helps prevent injury. In order to select appropriate PPE, employers must first evaluate the workplace with a hazard assessment. PPE may be categorized by the area of the body it protects. PPE is available in several types, designs, and materials. Every employer is responsible for providing the appropriate PPE for workers who require it, and it is every employee's responsibility to properly wear and use PPE. OSHA does not often specify which types of PPE should be worn, but requires that employers train each employee in proper use and retrain when PPE changes or if PPE is used improperly. After taking this class, users should be able to describe OSHA regulations regarding personal protective equipment and how they impact day-to-day operations in the workplace.

APPLIED TECHNOLOGIES

Competency	Course	Description
Electronics	Electrical Units 101	“Electrical Units” provides a foundational overview of electricity, including fundamental measures and terminology used to discuss electricity. Electricity is the flow of electrons, which are negatively charged particles. The amount of valence electrons in an atom determines how well it allows electricity to flow. There are two types of electricity, alternating current and direct current, but both flow from negative to positive. Current is measured by certain terms, including amperage, voltage, resistance, and wattage. Ohm’s Law and Watt’s Law describe the relationships between these values in a circuit.
	Introduction to Circuits 201	“Introduction to Circuits” provides a foundational overview of electrical circuitry. Whether wired in series, parallel, or a combination of the two, all circuits consist of a source, path, control, and load. Each of these components serves a purpose, and many circuits have extra components to prevent safety hazards and damage. Visual representations of circuits, such as schematic diagrams, use symbols of these components to illustrate the circuit’s layout. This method makes it easier to understand circuits and the rules that describe how they function, such as Kirchhoff’s Laws.
	Introduction to Magnetism 211	“Introduction to Magnetism” provides a thorough overview of magnetism and how it relates to electricity. Magnetism is a force of attraction and repulsion that occurs when the molecules in a material align. Materials become magnetized when they are exposed to a magnetic field. Materials can be demagnetized with heat, vibration, or a magnetic field generated by alternating current. Magnets have two different poles, like the earth. Magnetic forces exit the north pole of a magnet and are attracted to the south pole. These forces, or lines of flux, are essential for producing electricity with magnetic induction.
	Electrical Print Reading 261	“Electrical Print Reading” provides a fundamental overview of common electrical prints and symbols. The most common prints are pictorial, one-line, schematic, and wiring diagrams. Pictorial diagrams use illustrations to represent circuit components, but the other common types of diagrams use symbols. There are many different symbols, and some symbols have different variations. Diagrams include symbol keys to indicate what symbols represent, and sometimes symbols are labeled to make them easier to understand.
	Relays, Contactors, and Motor Starters 201	"Relays, Contactors, and Motor Starters" provides an overview of the primary components involved in electric motor control. Relays are electrical switches that control a circuit. When activated by current, a relay opens and closes a circuit to turn a larger current on or off. Contactors control current by conducting it through metal contacts that make or break electrical circuits. When combined with an overload relay, a contactor becomes a motor starter.
	Symbols and Diagrams for Motors 311	“Symbols and Diagrams for Motors” introduces different diagrams used to represent motor circuits and symbols that circuit diagrams commonly contain. Pictorial diagrams are the simplest and use illustrated pictures to represent circuit components. Schematic diagrams and line diagrams use symbols to represent components. Wiring diagrams also use symbols, but they are more detailed than the other types of diagrams. Most motor control devices are represented on a schematic diagram.
	Logic and Line Diagrams 312	“Logic and Line Diagrams” provides a comprehensive look at circuit logic and diagrams. The way a circuit functions depends on its circuit logic, which can be AND, OR, NAND, or NOR. The logic used in a circuit determines the layout of its corresponding line diagram. In general, line diagrams lay out the relationship between components on parallel lines. Line diagrams also include numbers to identify the location of components, the wires in the circuit, and the connections between components.

	Intro to PLCs 200	This class introduces the parts and operations of programmable logic controllers (PLCs) and describes the functions and different programming languages you will find on most PLCs.
Engineering Technology	Manufacturing Process Applications: Part I 124	This class introduces common metal shaping operations, including sheet and bulk metal processes, extrusion, forging, casting, and powder metallurgy.
	Manufacturing Process Applications: Part II 125	This class will introduce you to common finishing and coating processes, printed circuit board fabrication, and common material handling methods.
Fluids	Intro to Fluid Systems 100	This class introduces fluid power systems, including hydraulic and pneumatic components.
	The Forces of Fluid Power 110	This class introduces the forces of fluid power, including force multiplication, work, energy, and power.

ENGINEERING DRAWING & PRINTS

Competency	Course	Description
Applied Mathematics	Geometry: Lines and Angles 151	The class Geometry: Lines and Angles discusses the basic building blocks of all geometry: the line and the angle. Every print used in manufacturing is composed of lines and angles which must be interpreted to manufacture the depicted part. Though part geometry can be incredibly complex, all geometric prints can be broken down into simpler lines and angles. The relationships between the various angles formed when lines intersect can be used to solve geometry problems and interpret blueprints. An understanding of lines and angles is fundamental to learning and applying geometry as well as trigonometry and calculus. After taking this class, users should have a grasp on the types of lines and angles used in geometry, the angles that are formed by intersecting lines, and transversals. An understanding of the basics of geometry is necessary in various fields including inspection, part program applications, and other important areas of manufacturing.
	Geometry: Triangles 161	The class "Geometry: Triangles" discusses triangles and the specific mathematical operations unique to them. While the triangle is a very basic shape, it can be found as a part of more complex shapes. Triangles are often used as the basic shapes that compose three-dimensional CAD designs. Right triangles also form the basis of trigonometry. Since triangles are so commonly used, an understanding of the types of triangles and the methods for calculating missing information from them is essential to users.
	Geometry: Circles and Polygons 171	Circles and polygons, along with triangles, are the basic building blocks of any geometric figure. Knowledge of the calculations and uses of circles and polygons can prove useful when working with prints in any number of manufacturing capacities.
	Trigonometry: The Pythagorean Theorem 201	"Trigonometry: The Pythagorean Theorem" provides an explanation of the Pythagorean theorem and how it is used to solve various math problems involving and using right triangles. The class covers the use of powers and roots and the process that is used to solve for unknown dimensions on blueprints.
	Trigonometry: Sine, Cosine, Tangent 211	The class "Trigonometry: Sine, Cosine, and Tangent" discusses the three basic ratios that are the basis for trigonometry. Trigonometry is based on the specific relationships between the sides and angles of right triangles. Using trigonometry, a person can determine the missing angle and side measurements of a right triangle based on the information present in a drawing. Although solving

		trigonometric ratios often requires a calculator, users must know which ratios to apply to a particular problem and how to calculate them. In situations where parts are being manufactured, this knowledge is crucial to effective production of parts that require specific dimensions and angles.
	Trigonometry: Sine Bar Applications 221	"Trigonometry: Sine Bar Applications" discusses sine bars and the trigonometry required to use them. Sine bars are used when an angle needs to be machined, measured, or inspected. Sine bars are used with gage blocks to set a workpiece at an angle. To find the necessary measurements for the gage blocks or the sine bar angle, trigonometric ratios are used. These ratios include sine, cosine, and tangent. Gage pins are sometimes used with sine bars and gage blocks to increase the range of measurements.
	Concepts of Calculus 31	This class covers the basic concepts of calculus.
Print Reading	Blueprint Reading	The class "Blueprint Reading" provides a thorough understanding of blueprints and how to read them. Blueprints are documents that contain three major elements: the drawing, dimensions, and notes. The drawing illustrates the views of the part necessary to show its features. Together, the extension and dimension lines on the drawing indicate dimensions and specific tolerance information of each feature. The notes contain administrative and global information about the part. A blueprint contains all instructions and requirements necessary to manufacture and inspect a part.
Drafting/Drawing/Modeling	Introduction to CAD and CAM for Machining 241	"Introduction to CAD and CAM for Machining" provides a foundational overview of CAD and CAM systems and how they are used in CNC machining operations. While CAD greatly streamlines the process of part design, CAM ensures successful production by converting the part design into precise machine movements. This class describes CAD design methods, including the different types of part drawings and modeling, and the CAM data conversion process, including how toolpaths and movements are plotted based on design data.
Metallurgy	Introduction to Physical Properties 101	Intro to Physical Properties provides an overview of manufacturing materials and their physical properties, including thermal, electrical, and magnetic properties. This class also introduces users to volumetric characteristics, such as mass, weight, and density. Physical properties determine how a material will react to moisture, heat, electricity, and other factors. In order to choose the best tooling or raw material for an application, manufacturers must understand the physical properties of key metals, plastics, and other materials. After taking this course, users will be able to identify and describe key physical properties and their value in a manufacturing setting.
	Introduction to Mechanical Properties 111	"Intro to Mechanical Properties" provides a thorough introduction to key mechanical properties, such as tensile strength, hardness, ductility, and impact resistance. This class discusses how shear, compression, and tensile stress impact a material's properties, how force is shown on a stress-strain graph, and common methods manufacturers use to test a material's strength. To make quality products, manufacturers must anticipate how a material responds to shaping and cutting forces and understand how that material will ultimately function once it reaches the customer. Evaluating a material's mechanical and physical properties is the first step to choosing reliable tooling and processing methods. After taking Intro to Mechanical Properties, users will know more about hardness, ductility, and strength, what materials exhibit these characteristics, and common methods a facility might use to test these qualities.

MEASURING & IMPROVING WORK

Competency	Course	Description
Quality Assurance Programs	Total Quality Management Overview 261	"Total Quality Management" discusses the major principles of total quality management (TQM). TQM evolved from quality assurance methods, which emphasize quality by design. TQM is a management philosophy that focuses on customer satisfaction, since customers define quality. Efforts to improve quality are integrated throughout each stage of the industrial cycle. Leadership is responsible for creating and executing a strategic TQM plan, as well as establishing an open company culture that involves and empowers all employees. There are many methods that can be used to measure, analyze, and implement TQM.
Continuous Process Improvement	SPC Overview 211	"SPC Overview" offers a thorough introduction to the purpose and main concepts of statistical process control (SPC). This class describes different types of control charts, such as X bar, R, and P charts, and how these tools are used to determine if a process is in-control or out-of-control.
Lean Principles	Lean Manufacturing Overview 101	"Lean Manufacturing Overview" provides an introduction to the principles and terminology of lean strategies, including a discussion of the seven forms of waste, the definition of value-added, the difference between push and pull systems, and the importance of continuous improvement. This class also highlights other quality concepts, such as single minute exchange of dies (SMED), inventory reduction, and Five S.
	Cell Design and Pull Systems 161	"Cell Design and Pull Systems" introduces the origin, purpose, and advantages of cellular manufacturing. This class describes the basic characteristics of a work cell, along with how cells are planned, organized, and improved. Cell Design and Pull Systems also includes a discussion of related quality concepts, such as takt time, cycle time, kanban systems, and error prevention.
	Metrics for Lean 231	"Metrics for Lean" introduces the information and data used to track processes in lean manufacturing facilities, including takt time, cycle time, total time of operations, overall equipment effectiveness (OEE), and first-time quality.
Project/Program Management	Manufacturing Management 180	This class covers a number of management topics, including project planning, organizational design, theories of leadership and labor relations.