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Secondary Competency Task List

ENGINEERING SAFETY

Implement a safety plan.

Operate lab equipment according to safety guidelines.

Use appropriate personal protective equipment.

Comply with OSHA and EPA regulations for a safe work site.

Identify emergency first aid procedures.

Maintain safe working practices around tools and equipment.

Participate in classroom and laboratory management and clean-up activities.

Demonstrate a professional attitude toward classroom and laboratory activities.

Demonstrate lockout/tag out procedures.

KNOWLEDGE OF ENGINEERING

Demonstrate knowledge of the history of engineering.

Investigate engineering careers, training and associated opportunities.

Explain the purpose and functions of an engineering team.

ETHICS IN ENGINEERING

Analyze current Professional Engineering codes of ethics.

Analyze ethical engineering issues.

Analyze and explain ethical and technical issues contributing to an engineering disaster.

PROBLEM SOLVING IN ENGINEERING

Identify the engineering problem.

Gather information about problems and solutions.

Identify information resources.

Apply steps in the problem solving method.

RESERVE

TEAMWORK

Actively participate as a member of an engineering project team.

Apply constructive feedback.

Resolve conflict within the team.

Demonstrate active listening techniques.

Demonstrate formal and informal speaking skills.

Explain the importance of selling a project idea to team members.

Identify ways to motivate, coach, counsel, and reward individuals and teams.

Perform a team peer review.

Perform evaluations (e.g. self-evaluation and management evaluation).

ENGINEERING GRAPHICS

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Proper use of graphics equipment and tools.
Describe various types of drawings.
Perform metric-U.S. system conversions.
Use engineer's and architect's scales.
Prepare freehand sketches.
Apply line conventions.
Prepare orthographic projection drawings.
Prepare additional views to clarify the design.
Apply principles of dimensioning and annotation.
Prepare drawings for product assembly, fabrication, or construction.
Create schematics.
Revise an existing drawing to meet modifications or changes.
ENGINEERING DESIGN PROCESSES
Identify the steps of an iterative design process.
Create an engineering solution for a real-world problem.
Determine whether design is safe for a given user.
Generate a design improvement to address specific flaws/failures.
Create a proposal for an engineering project.
Participate in a design review.
Prepare a schedule for a design project.
MODELING
Identify the three areas of modeling (i.e., physical, conceptual, and mathematical).
Create a scale model or working prototype.
Evaluate a scale model or a working prototype.
RESERVE
RESERVE
MANUFACTURING AND INDUSTRIAL SYSTEMS
Research the history of manufacturing and its milestones.
Research a topic in manufacturing.
Describe procedures used in manufacturing.
Identify basic flowcharting and discuss their functions.
Create and apply a flowchart that portrays a manufacturing process.
Create a control system that replicates a factory cell.
RESERVE
Evaluate a product prototype and the processes used in its manufacture.
MANUFACTURING PROCESSES
Demonstrate how research is used in Engineering Economics.
Demonstrate the relationship of time and cost to manufacturing systems.
Explain the difference between primary and secondary manufacturing processes.
Evaluate and present a production line activity.
Outline the product-development process.

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Plan steps of production for a manufactured product.
List tools needed for a manufactured product.
Make a list of the production processes in manufacturing.
Apply manufacturing systems to develop and produce a prototype for a product.
Evaluate a product prototype and the processes used in its manufacture.
Write a step-by-step procedure for an assembly.
Identify methods and sources for obtaining materials and supplies.
Compile a materials list that includes vendors and costs for all required materials and equipment to build the prototype.
COMPUTER ASSISTED MANUFACTURING (CAM)
Prepare a process, identify machines that will be used to carry out the process, and then describe the work that each machine performs.
Research the history and industrial use of CAM.
Demonstrate how to use CAM software to create a program for a machine part.
POWER AND ENERGY
Define "Power."
Discuss the forms of potential energy.
Design a vehicle that stores and releases potential energy for propulsion.
Discuss the forms of kinetic energy.
Research methods of energy conversion (e.g., electrical, fluid, mechanical).
Define terms used in power systems.
Name the Laws of Thermodynamics.
MECHANICAL ADVANTAGE AND MECHANISMS
Locate and explain examples of the six simple machines, their attributes and components.
Measure forces and distances related to mechanisms.
Calculate mechanical advantage and drive ratios of mechanisms.
Design, create, and test various drive systems.
Determine efficiency in a mechanical system.
Convert power between units.
Measure torque, and use it to calculate power.
Demonstrate principles of mechanical systems as they relate to power transmission.
FLUID POWER SYSTEMS
Design, create, and test a fluid power system.
Identify components of a fluid system.
Calculate values in a fluid power system, using Pascal's Law.
Calculate values in a pneumatic system, using the ideal gas laws.
Calculate flow rate, flow velocity, and mechanical advantage in a fluid power system.
Maintain a fluid power system.
GREEN ENERGY
Produce mechanical power, using alternative energy systems.
Research renewable/non renewable energy sources.

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Study energy efficiency and conservation.
Create a model that will utilize a renewable energy concept.
Investigate bio-degradable materials for an alternative energy source.
Prepare a concept of an alternative energy for transportation.
MACHINE CONTROLS AND AUTOMATED SYSTEMS
Choose appropriate machine control inputs and outputs, based on the need of a technological system.
Design and create a control system, based on given needs and constraints.
Differentiate between the characteristics of digital and analog devices.
Select between open and closed loop systems to solve a technological problem.
Create system control programs using flowchart logic.
Define and discuss open and closed loop systems.
Create and use flowcharts.
Identify components needed to integrate computer controls for an automated system.
Plan, design, and construct an automated system.
Program an automated system using computer hardware and software.
Interface system output to an other automated system.
Create and program a simulated work cell with simulation software.
Demonstrate the ability to program timers, counters and loops.
Identify and explain various types of motors.
Interface output devices to a computer, microcontroller or programmable logic controller.
PROPERTIES OF MATERIALS
Describe the properties of materials.
Investigate methods used to alter materials.
Illustrate causes of failure in materials.
Calculate material properties relating to a stress strain curve.
Create a written report of material test evaluations.
NATURAL, COMPOSITE AND SYNTHETIC MATERIALS
Investigate various types of metals and application.
Investigate various types of manufacturing wood and applications.
Investigate various types of ceramics and applications.
Investigate various composite and synthetic materials.
Solve a problem, design a product, or a prototype, that requires natural, composites and/or synthetic materials.
STRENGTH OF MATERIALS
Demonstrate knowledge of the principles of statics and dynamics to calculate the strength of various engineering materials used to build a structure.
Create free body diagrams of objects, identifying all forces acting on the object.
Locate the centroid of a rectangle and a triangle, using mathematics.
Calculate the moment of inertia for a rectangular shape.
Differentiate between scalar and vector quantities.
Identify magnitude, direction, and sense of a vector.
Calculate the X and Y components, given a vector.

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Calculate moment forces, given a specified axis.
KINEMATICS
Given a set of data, calculate distance, displacement, speed, velocity, and acceleration.
Calculate acceleration due to gravity, based on data from a free-fall device.
Calculate the X and Y components of a projectile motion.
Determine the needed angle to launch a projectile a specific range, given the projectile's initial velocity.
TOTAL QUALITY CONTROL
Explain the eight "Ms" as they relate to toal quality control in the manufacturing industry: Machines, Methods, Materials, Manpower, Measurement, Milieu, Management, and Maintenance.
Demonstrate knowledge of ISO quality standards.
Demonstrate the application of the following Total Quality Management techniques: Cause and Effect Diagram, Check Sheet, Control Chart, Histogram, Pareto Chart, Scatter Diagram, and Flow Chart.
Create a total quality control checklist for a product.
Communicate total quality control expectations to user groups.
Identify how to correct, and improve, a finding from an inspection document.
Develop a report of total quality control inspection observations and findings.
PRECISION MEASUREMENT FOR INDUSTRY
Convert numbers between the hexadecimal or octal number systems and the decimal number system.
Make linear measurements accurately to 1/16".
Use a micrometer to measure accurately to .001".
Use a dial caliper to measure accurately to .001".
Use combination squares and protractors for angular measurement.
Use a height gauge to layout and measure part to measure accurately to .001".
Use inside micrometers and telescoping gauges to measure accurately to .001".
Identify the way numbers are expressed in scientific notation, engineering notation, and System International (SI) notation.
BASIC ELECTRICITY AND ELECTRONICS
Identify and demonstrate safety rules in the use of electrical lab machines and equipment.
Define and describe basic terms in electricity and electronics.
Identify electrical and electronic symbols on a schematic.
Follow a schematic and construct series and parallel electrical and electronic circuits.
Identify resistors by type and value.
Describe various types of sensing and control devices.
Use a digital multi-meter to measure circuit values of current, resistance, and voltage.
Compute values of current, resistance and voltage using Ohm's Law.
Compare DC and AC waveforms, using an oscilloscope.
Analyze and measure values in AC circuits (including inductance, capacitance, reactance, and LRC circuits).
Calculate voltage, amperage, resistance, and power in all types of circuits.
Troubleshoot all types of circuits.
Identify functions, operation, and characteristics of grounding systems.
Interpret the NEC requirements for electrical installations.
RESERVE

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Identify and install electrical panel boards and switchboards.
Identify, select, and install over-current devices.
Identify/install various ground fault circuit interrupter (AFCI & GFCI) and arc fault devices.
Explain transformer operation.
Describe and identify types of oscillators.
Identify and describe semiconductor atomic structure and construction methods.
Construct an amplifier circuit and verify the characteristics.
Construct a power supply circuit and verify operation.
Use circuit simulation software to construct and analyze digital and microprocessor circuit characteristics.
Identify and explain various types of motors, e.g. induction, etc., and the principles of their operation.

PA Academic Standards for Career Education and Wor

The Career Education and Work (CEW) Standards were developed by the Pennsylvania Department of Education and complement all disciplines and other academic standards. These skills outline certain skills that students need to obtain prior to high school graduation if they are to succeed in the workplace. ***Although they are not required under each CIP Code's Program of Study Task List, the School District of Philadelphia requires that all CTE students are taught and master these essential skills.***

Click on the following links for more information on the CEW Standards:

PA Dept. of Education CEW Website

CEW Standards

Career Awareness and Preparation

Relate careers to individual interests, abilities, and aptitudes.
Analyze career options based on personal interests, abilities, aptitudes, achievements and goals.
Analyze how the changing roles of individuals in the workplace relate to new opportunities within career choices.
Evaluate school-based opportunities for career awareness/preparation, such as, but not limited to career days, community service, internships, and job shadowing.
Justify the selection of a career.
Analyze the relationship between career choices and career preparation opportunities, such as, but not limited to college degrees, certificates/licensures, entrepreneurship, and industry and military training.
Assess the implementation of the individualized career plan through the ongoing development of the career portfolio.
Review personal high school plan against current personal career goals and select postsecondary opportunities based upon personal career interests.

Career Acquisition (Getting a Job)

Apply effective speaking and listening skills used in a job interview.
Apply research skills in searching for a job utilizing various job search resources (e.g. CareerLinks, O-Net, Professional Organizations).
Develop and assemble, for career portfolio placement, career acquisition documents, such as, but not limited to job application, letter of introduction, postsecondary education/training applications, request for letter of recommendation and resume.

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Analyze, revise, and apply an individualized career portfolio to chosen career path.

Demonstrate, in the career acquisition process, the application of essential workplace skills/knowledge, such as, but not limited to commitment, communication, dependibility, health/safety, and scheduling/time management.

Career Retention and Advancement

Evaluate personal attitudes and work habits that support career retention and advancement.

Evaluate team member roles to describe and illustrate active listening techniques such as clarifying, encouraging, and summarizing.

Evaluate conflict resolution skills as they relate to the workplace such as constructive criticism, group dynamics, managing/leadership, negotiation and problem solving.

Develop a personal budget based on career choice, such as, but not limited to charitable contributions, fixed/variable expenses, gross and net pay, and savings.

Evaluate time management strategies and their application to both personal and work situations.

Evaluate strategies for career retention and advancement in response to the changing global workplace.

Evaluate the impact of lifelong learning on career retention and advancement.

Entrepreneurship

Analyze entrepreneurship as it relates to personal career goals and corporate opportunities.

Analyze entrepreneurship as it relates to personal character traits.

Develop a business plan for an entrepreneurial concept of personal interest and identify available resources, such as, but not limited to community-based organizations, financial institutions and venture capital.

Signed:

CTE Instructor

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PA State ID # (10-digits)

Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

Key

N = Not Exposed to Task

1 = Knowledge (Exposed to Task)

2 = Guidance (Accomplishes Task w/ Instructor Help)

3 = Mastery (Accomplishes Task w/o Instructor Help)

Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

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Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

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Key

N = Not Exposed to Task

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Year 1	Year 2	Year 3	Inst. Initials (*if 3 is Achieved*)

Date

Key **N** = Not Exposed to Task **1** = Knowledge (Exposed to Task) **2** = Guidance (Accomplishes Task w/ Instructor Help) **3** = Mastery (Accomplishes Task w/o Instructor Help)			
Year 1	**Year 2**	**Year 3**	**Inst. Initials** (*if 3 is Achieved*)