|  |  |
| --- | --- |
| **Course Number:** | 8709 (OK Promise/OHLAP Computer Credit) |
| **Pre-requisite:** | None |
| **Career Cluster/Pathway:** | STEM/Engineering & Technology |
| **Locations:** | Various locations across the state |
| **Length:** | 120 hours |

**Course Description:** Students dig deep into the engineering design process, applying math, science, and engineering standards to hands-on projects like designing a new toy or improving an existing product.

**Specific Learning Competencies:**

**The student will demonstrate professional standards/employability and leadership skills as required by business and industry. The student is expected to:**

* Employ the Technology Student Association (TSA) student organization or other approved CTSO program as an integral element of the curriculum.
* Demonstrate knowledge of how to dress, speak, and conduct oneself in a manner appropriate for the profession;
* Show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;
* Participate in problems-solving, both individually and as part of a team.
* Understand the importance of inter-disciplinary teams.
* Present written and oral communication in a clear, concise, and effective manner;
* Demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and
* Demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

**The student will gain CAD and drafting experience in the following ways:**

* Create and/or modify 3D solid computer models of complex parts
* Create 3D models of part assemblies
* Create technical drawings of complex parts and assemblies from 3D solid models using
* CAD software
* Apply drive constraints and simulate motion of an assembly within the 3D modeling environment
* Create concept sketches to represent ideas
* Create hand drawn technical drawings to represent a simple part that may include an isometric view, orthographic projections and a section view

**The student will participate in the design process experience in the following ways:**

* Design a consumer product using an engineering design process based on a design brief
* Solve a problem using an engineering design process
* Document in detail the engineering design process used to solve a problem or design a product
* Create a detailed and comprehensive design brief
* Brainstorm/recommend improvements to a product based on reverse engineering
* Produce a detailed technical report to present the solution to a problem or a product design
* Describe the lifecycle of a consumer product
* Work collaboratively on a design team to design a product or solve a problem

**The student will develop the following computational and analytical skills:**

* Use Excel to calculate summary statistics and create histograms
* Use Excel to find a trend line (mathematical model) to represent data and interpret the model within the
* context of the data
* Complete multi-step engineering calculations
* Make predictions based on data
* Use data to inform decisions
* Perform precision measurement using a dial caliper
* Convert among and between SI and US Customary
* Calculate physical properties (surface area, volume, density) of simple 3D forms
* Determine a parametric equation that describes a relationship between two quantities

**The student will develop the following professional skills:**

* Team collaboration
* Project management
* Problem-solving
* Communication skills
* Presentation skills
* Technical writing

**The student will be exposed to the following tools and software:**

* Microsoft Office (Excel, Word, PowerPoint)
* 3D solid modeling software - Autodesk Inventor
* Dial calipers

**The student will be exposed to the following course knowledge:**

* Careers
  + Engineering disciplines
  + STEM careers related to engineering
  + Professional ethics
* Design Process
  + Define the problem – design brief
  + Generate concepts – brainstorming and decision matrices
  + Develop a solution – technical drawing
  + Construct and test a prototype
  + Evaluate a solution
  + Present a solution
  + Product life cycle
  + Design teams
* Technical Sketching and Drawing
  + Isometric views
  + Perspective views
  + Orthographic projections
  + Section views
* Measurement
  + Linear measurement
  + Unit conversion
  + Precision and Accuracy
  + Dimensioning
  + Tolerance, fit and allowance
  + Physical property analysis
* Statistics
  + Measures of central tendency
  + Measures of variation
  + Histograms
  + Normal Distribution
  + Sample versus population statistics
  + The Empirical Rule (65-95-99 Rule)
* Modeling in Engineering
  + Graphical modeling
  + Mathematical modeling
  + Computer 3D solid modeling
  + Physical modeling and prototyping

**The student will follow the following safety practices:**

* Identify potential safety hazards and follow general laboratory safety practices
  + Assess workplace conditions with regard to safety and health.
  + Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
  + Locate and understand the use of shop safety equipment.
  + Select appropriate personal protective equipment.
* Use safe work practices.
  + Use personal protective equipment according to manufacturer rules and regulations.
  + Follow correct procedures when using any hand or power tools.
* Complete a basic safety test without errors (100%) before using any tools or shop equipment.

**The student will understand and create an engineering notebook:**

* Make accurately proportioned sketches using correct drawing conventions.
  + Notes are neat and legible.
  + Objects should be drawn to correct proportions.
  + Dimensions are used appropriately.
  + Views can be isometric, orthogonal, sections, or assemblies.
* Create and utilize an engineering notebook per established conventions.
  + Sequential and chronological.
  + Accurate and complete reflection of the progress being recorded.
  + Sketches or pictures are included where appropriate.
  + No loose entries or pages.
  + Each page is dated and witnessed.
  + Unused spaces are identified and lined out.
  + Errors are not erased or obliterated.
  + Test data and calculations are included.

**Methods of Instruction include:**

Lectures, class discussions, hands-on-training, demonstrations, projects and performance evaluation.

|  |  |
| --- | --- |
| **Required Testing:**  Industry Certification: | (Select from the following options)  Autodesk: Revit Certified User (2757)  Starrett Angle Measurement (2358)  Starrett Caliper Measurement (2359)  Starrett Micrometer Measurement (2362)  Starrett Tape and Rule Measurement (2363) |
| PLTW EoC: | Introduction to Engineering Design (4611) |
|  |  |

**Recognized Primary Course Textbooks and Instructional Resources:**

1. PLTW: <https://www.pltw.org/our-programs/pltw-engineering-curriculum#curriculum-1>
2. ctYOU: Resources by subject <https://ctyou.org/mod/book/view.php?id=324688>
3. Oklahoma Career Guide: <https://okcareerguide.kuder.com/landing-page>
4. TSA
   1. <https://www.oktsa.org/>
   2. TSA Toolkit <https://tsaweb.org/resources/information/toolkits>
   3. TSA Affiliation:  <https://www.registermychapter.com/tsa/nat/AffLogin.aspx>
   4. Total TSA (change log On To Total TSA) <https://www.registermychapter.com/tsa/nat/AffLogin.aspx>