Course Number: ST00022
OCAS Code: 8716
Course Length: 120 Hours
Career Cluster: Science, Technology, Engineering and Mathematics
Career Pathway: Engineering and Technology
Career Major(s): PLTW Pre-Engineering (Comprehensive High Schools), PLTW Pre-Engineering
Pre-requisite(s): Introduction to Engineering Design, Principles of Engineering, Digital Electronics

Course Description: Engineering Design and Development is an engineering research course in which students work in teams to research, design and construct a solution to an open-ended engineering problem. Students identify a problem, complete extensive research, apply principles developed in the preceding courses, and are guided by a community mentor. They must present progress reports, submit a final written report, and defend their solutions to a panel of outside reviewers at the end of the course.

Textbooks: Project Lead the Way Materials

Course Objectives:

A. Demonstrate Knowledge of Engineering Design and Development
   1. Justification of Course/Project
      a. Syllabus/scope and sequence
      b. Testimonials/previous projects
      c. Getting beyond the book report
   2. Course Expectations
      a. Structure and grading of projects
      b. Instructor evaluation/student evaluation
      c. Levels of performance
      d. Presentation of rubrics
      e. Final presentation
      f. Student resume
      g. Student portfolio

B. Discuss Elements of Formal Research
   1. Use Daily Research Journal
      a. Documenting the process
         i. Sketches, renderings, pictures
         ii. Working drawings
         iii. Technical data
      b. Source Information
         i. Contacts
         ii. Contact log
         iii. Record source information
         iv. Thoughts/note cards/quotes
2. Conventional Library Resources
   a. Reader’s guide to periodicals
   b. General references
   c. Inter-library loan
   d. Microfiche, vertical file catalog
   e. Librarians as a resource

3. Using the Computer as a Research Tool
   a. Internet
   b. Search engines/strategies
   c. On-line databases
      i. Academic
      ii. Government resources
      iii. People searches
      iv. Patent searching
      v. Business search
   d. E-mail
      i. Setting up an account/configuring the program
      ii. Person-to-person communication

4. Contacting the experts
   a. Interpersonal communication skills
   b. Phone skills
   c. Business letter
   d. Personal interviewing skills
   e. Thank you letters

C. Participate in Guided Research

1. Topics for Research
   a. Methods of brainstorming
   b. Introduce topic area

2. Gaining the Knowledge
   a. Research the topic
   b. Gathering information to define your topic.
      i. Identify related terminology and concepts
      ii. History of your topic
      iii. Relevant current events
   c. Summation of information gathered

3. Writing A Problem Statement
   a. Problem statement activity
   b. Developing specifications and constraints
   c. Decision matrix
   d. Justification of problem statement

4. Researching Alternative Solutions
   a. List of all solutions
   b. Advantages and disadvantages matrix of each solution

5. Developing Alternative Solutions
   a. Improve one alternative
   b. Combining alternatives
   c. Entirely new alternative
   d. Select most viable alternative

6. Redefining and Justifying Alternative Solutions
   a. Originality of alternative
      i. Merit of alternative solution
      ii. Collecting professional opinions
      iii. Surveys
   b. Feasibility of solution
ENGINEERING DESIGN AND DEVELOPMENT

7. Using Various Presentation Methods
   a. Multi-media
      i. PowerPoint presentations
      ii. Slide photography
      iii. Transparencies
      iv. Modeling and demonstration considerations
      v. Video and audio recording techniques
   b. Developing presentations
   c. Presenting your findings

D. Perform Independent Research ¹
1. Expectations for Independent Research
   a. Progress report
   b. Obtaining materials
   c. Time management
   d. Independent research
      i. Brainstorming
      ii. Narrow problem focus
      iii. Writing problem statement
      iv. Researching alternative solutions
      v. Developing alternative solutions
      vi. Redefining and justifying alternative solutions

2. Developing the Prototype
   a. Prototyping methods
      i. Drafting or concept modeling
      ii. Evaluate gathered materials
      iii. Construction of prototype
         a) Safety, tools, labs and equipment
   b. Test Prototype
      i. Professional opinions
      ii. Qualitative and quantitative field testing
      iii. Evaluating the data for validity
   c. Improving the Design
      i. Redefine constraints and specifications
      ii. List modifications
      iii. Implement modifications

3. Writing a Technical Research Paper
   a. Research and writing
   b. Mechanics of writing
   c. Format of a technical research paper
   d. Documentation of sources

E. Make a Formal Presentation ¹
1. Prepare and Deliver Formal Presentation
   a. Review grading procedures
   b. Evaluation panel
   c. Delivery of presentation
   d. Feedback
   e. Prepare final documents

¹PLTW objective
Teaching Methods: The class will primarily be taught by the lecture and demonstration method and supported by various media materials to address various learning styles. There will be question and answer sessions over material covered in lecture and media presentations. Supervised lab time is provided for students to complete required projects.

Grading Procedures: 1. Students are graded on theory and shop practice and performance.
2. Each course must be passed with seventy (70%) percent or better.
3. Grading scale: A=90-100%, B=80-89%, C=70-79%, D=60-69%, F=50-59%.

Description of Classroom, Laboratories, and Equipment: Tulsa Technology Center campuses are owned and operated by Tulsa Technology Center School District No. 18. All programs provide students the opportunity to work with professionally certified instructors in modern, well-equipped facilities.

Available Certifications/College Credit: The student may be eligible to take state, national or industry exam after completion of the program. College credit may be issued from Oklahoma State University-Okmulgee or Tulsa Community College. See program counselor for additional information.

College Credit Eligibility: The student must maintain a grade point average of 2.0 or better.