



Introduction to Engineering Design

CURRICULUM OUTLINE

INSTRUCTOR: Bill Ryan

Pathway To Engineering
**Introduction to
Engineering Design**
A Specialization Course

*Forging new
generations of
engineers*

The major focus of the IED course is to expose students to design process, engineering standards, research and analysis, technical documentation, global and human impacts, communication methods, and teamwork.

ACADEMY: Engineering and Design
ROOM: ED 213

COURSE INSTRUCTOR: Bill Ryan
Office: ED 211
PHONE: 896-5789
EMAIL: bryan@rrhs.rrps.k12.nm.us

PREREQUISITE(S): C or better in Algebra 1 or equivalent
Approval of the Instructor

SUPPLIES: **Notebook - 2 inch, 3 ring binder for Portfolio**
Calculator (with sin, cos, tan functions)
Pencils
Paper

**ALL ARE
REQUIRED**

Pathway To Engineering

The PLTW Curriculum: How and Why it Works

All PLTW high school courses have several underlying content areas in common. As students progress through the sequence they will become proficient in:

- working as a contributing member of a team
- leading a team
- using appropriate written and/or visual mediums to communicate with a wide variety of audiences
- public speaking
- listening to the needs and ideas of others
- understanding the potential impact their ideas and products may have on society
- thinking
- problem solving
- managing time, resources and projects
- researching
- going beyond the classroom for answers
- data collection and analysis
- preparing for two-and four-year college programs.

PLTW's curriculum makes math and science relevant for students. By engaging in hands-on, real-world projects, students understand how the skills they are learning in the classroom can be applied in everyday life. This approach is called activities-based learning, project-based learning, and problem-based learning or APPB-learning.

Research shows that schools practicing APPB-learning experience an increase in student motivation, an increase in cooperative learning skills and higher-order thinking, and an improvement in student achievement.

Activities are a method of instruction that involves directed teaching of a particular process or procedure. Activities engage students in learning skills that are later applied in more complex situations. Activities lead students to higher levels of learning.

Project-based learning is a comprehensive approach to instruction that presents a project or relevant activity that enables students to synthesize knowledge and to individually resolve problems in a curricular context.

Problem-based learning is both a curriculum organizer and an instructional strategy that presents a problem, which is relevant and related to the context where students are the stakeholders. Students synthesize and construct knowledge to help them actively grapple with the complexities of the problem and develop strategies to direct their own learning. When students experience a problem in context, they are more likely to make connections and thus see the value in what they are learning.

Curriculum Outline

Unit 1: Design Process

Lesson 1.1 Introduction to a Design Process

- 1.1.1 Basic Design Tools
- 1.1.2 Introduction to Research
- 1.1.3 Modeling

Lesson 1.2 Introduction to Technical Sketching and Drawing

- 1.2.1 Basic Line Conventions
- 1.2.2 Pictorial Sketches
- 1.2.3 Introduction to Multiview Drawings

Lesson 1.3 Measurement and Statistics

- 1.3.1 History of Measurement
- 1.3.2 English and Metric Linear Measurements
- 1.3.3 Dial Caliper Measurement
- 1.3.4 Linear Dimensions
- 1.3.5 Applied Statistics

Lesson 1.4 Puzzle Cube

- 1.4.1 Puzzle Design Challenge
- 1.4.2 Puzzle Part Combinations

Unit 2: Design Exercise

Lesson 2.1 Geometric Shapes and Solids

- 2.1.1 Geometric Shapes
- 2.1.2 Geometric Solids
- 2.1.3 Calculating Area
- 2.1.4 Calculating Properties
- 2.1.5 CAD Fundamentals

Lesson 2.2 Dimensions and Tolerances

- 2.2.1 Dimensioning Conventions
- 2.2.2 Tolerances

Lesson 2.3 Advanced Modeling Skills

- 2.3.1 Parameters
- 2.3.2 Auxiliary Views
- 2.3.3 Section Views
- 2.3.4 Feature-Based Solid Modeling
- 2.3.5 Assembly Modeling
- 2.3.6 Assembly Drawing Standards
- 2.3.7 Exploding Assemblies
- 2.3.8 Assembly Animation

Lesson 2.4 Advanced Designs

- 2.4.1 Advanced Designs
- 2.4.2 Design Process
- 2.4.3 Teamwork
- 2.4.4 Decision Matrix
- 2.4.5 Revision Blocks

2.4.6 Assembly Drawing Standards

Unit 3: Reverse Engineering

Lesson 3.1 Visual Analysis

- 3.1.1 Visual Design Elements
- 3.1.2 Visual Design Principles
- 3.1.3 Composition

Lesson 3.2 Functional Analysis

- 3.2.1 Identifying Subsystems
- 3.2.2 System Analysis

Lesson 3.3 Structural Analysis

- 3.3.1 Structural Connections
- 3.3.2 Precision Measurement
- 3.3.3 Material Analysis
- 3.3.4 Property Analysis
- 3.3.5 Finite Element Analysis

Lesson 3.4 Product Improvement By Design

- 3.4.1 Researching Product History and Evolution
- 3.4.2 Product Innovation
- 3.4.3 Problem Identification
- 3.4.4 Writing a Design Brief
- 3.4.5 Brainstorming
- 3.4.6 Design Critique
- 3.4.7 Technical Report

Unit 4: Open-Ended Design Problems

Lesson 4.1 Marketing and Graphic Design

- 4.1.1 Marketing
- 4.1.2 Packaging Design
- 4.1.3 Advertising
- 4.1.4 Graphic Design

Lesson 4.2 Engineering Design Ethics

- 4.2.1 Human Impacts
- 4.2.2 Product Lifecycle
- 4.2.3 Design For Disassembly (DFD)
- 4.2.4 Environmental Protection Agency (EPA)
- 4.2.5 Occupational Safety and Health Administration (OSHA)

Lesson 4.3 Design Teams

- 4.3.1 Teamwork
- 4.3.2 Project Planning
- 4.3.3 Assessment
- 4.3.4 Meetings
- 4.3.5 Virtual Teams

ADDITIONAL INFORMATION

1. MATERIALS

Bring the basic materials to class everyday: paper, pencil, and calculator. I strongly advise you to get a system to take notes and to organize your folder with handouts, quizzes, and tests. This will be very helpful when it is time to study for exams. The sample problems we do in class are extremely important to have written down!

2. EXTRA HELP

This is your responsibility. The resource time is every morning and I am also available after school. If you do not understand a concept or a problem, or you want to review, make the time to go in and ask. I am usually in the room by 7:00 am before school. Help is available, but you must ask!

3. ATTENDANCE

It is important to be in class. Except for the day of a test, everyday is a new lesson, a more in-depth look at a topic, or a review. If you are absent, it is **YOUR RESPONSIBILITY** to obtain and make up all missed work. Cuts and tardiness will be followed by the procedures in handbook.

IT IS YOUR RESPONSIBILITY TO KNOW (come to me or ask a classmate) THE HOMEWORK and/or TEST & QUIZZES THAT YOU MISS WHEN YOU ARE ABSENT!! I WILL NOT CHASE YOU DOWN!!!!

4. DISCIPLINE

Please be: respectful, trustworthy, responsible, helpful, and caring. Please do not stand near the door at the end of a period. The words we use should be appropriate for a classroom. It is my responsibility to provide a classroom environment that is safe and conducive to learning for all students. If you prevent this then you will be disciplined.

**All cell phones must be turned off!! Don't be rude!!! If it goes off in class I reserve the right to confiscate it and have you pick it up at the end of the day.

5. ASSIGNED WORK

Assigned work will be monitored daily. Neatness is part of the grade, that is, if I have to guess, then I will probably guess wrong. Remember, good work takes time and energy. Please put your name and assignment number in the upper right hand corner. Some work will require you to write out the problem.

6. NOTE TAKING and NOTEBOOKS

Notes are to be taken during class. These are for your benefit and they really work. You are allowed to use notes for quizzes and exams ***BUT NOT THE FINAL***, so take good notes.

The FINAL EXAM will be NO NOTES. This is a PLTW requirement.

7. DAY OF TESTS/TEST TAKING PROCEDURES

- Only pencils will be used for tests. You could have points deducted if you use a pen on the test.

- IF YOU ARE ABSENT ON THE DAY OF A TEST – YOU MUST MAKE IT UP IN THE TIME FRAME THAT YOU AND I AGREE. I WILL NOT CHASE YOU DOWN. IF YOU DO NOT, I RESERVE THE RIGHT TO GIVE YOU A ZERO FOR THAT TEST.

****Parents:** By signing this, you are verifying that you saw the syllabus and were able to read through as much of it as desired.

(Please complete and return by Friday)

Student Name (PRINT): _____

Student Signature: _____

Parent Signature: _____

DATE: _____

Parent Email Address: _____



Rio Rancho Public Schools Parent Waiver and Consent to Use of Student Information and Images on the RRPS Website

Many programs, activities, and events taking place in the Rio Rancho Public Schools are of interest to the public. Often civic, athletic, educational, fine arts or other organizations are interested in learning about our students and programs. From time to time, we record digital images of students participating in these events and desire to share these with the community via our website (district or school levels) to provide information to the public about our programs and services.

Given the global nature of the internet, RRPS has policies that prohibit the posting of any student images or identifying information on our website without expressed written permission from the parent. It is our intent to aggressively protect student and family rights to privacy, and endeavor to publish student work and accomplishments on our site only as a means of sharing students' successes with our community. Please visit our website (www.rrps.net) to view our specific policies regarding the protection and sharing of student information (#326, #327) and our web policy (#479).

Consent to Use of Student Information on RRPS District Web Sites

The undersigned parent or legal guardian of (student name) _____, a student of the Rio Rancho Public School District (RRPS), agrees and consents to the posting of photographs or visual reproductions of the student in connection with regular and extracurricular activities on the district website. The undersigned understands that the use of any image is temporary and will not be stored by RRPS in any permanent archive (digital or otherwise).

The undersigned retains the right to refuse the posting of any particular image and to request the removal of any image at any time.

Signature of Parent or Legal Guardian

Date

Bill Ryan
Teacher

RRHS
Grade