

## **Principles of Engineering (POE)**

### **2015-16 Course Syllabus**

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#### **Course Description:**

Principles of Engineering is the second foundation course in the **Project Lead The Way (PLTW)** Pathway To Engineering sequence. This survey course exposes students to major concepts they'll encounter in a postsecondary engineering course of study. Topics include mechanisms, energy, statics, control systems, materials, and kinematics. Students develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges, document their work, and communicate solutions. This is a required foundational course for PLTW. **This course meets every day of the 6 day cycle and has a 1.06 weighted grade point value.**

#### **Objectives:**

Upon successful completion of the course, students will be able to:

- A. Distinguish between the six simple machines, their attributes, and components.
- B. Calculate work and power, and the efficiency in a mechanical system.
- C. Calculate power in a system that converts energy from electrical to mechanical.
- D. Determine the efficiency of a system that converts electrical input to a mechanical output.
- E. Test and apply the relationship between voltage, current, and resistance in various circuits.
- F. Create free body diagrams of objects, identifying all forces acting on the object.
- G. Use equations of equilibrium to calculate unknown forces.
- H. Identify and calculate test sample material properties using a stress strain curve.
- I. Design and create a control system based on given needs and constraints.
- J. Calculate values in a pneumatic system, utilizing the perfect gas laws.
- K. Calculate flow rate, flow velocity, and mechanical advantage in a hydraulic system.
- L. Calculate the theoretical probability that an event or multiple events will occur.
- M. Calculate the experimental frequency distribution of an event occurring.
- N. Calculate the X and Y components of a projectile's motion
- O. Determine the angle needed to launch a projectile a specific range given the projectile's initial velocity.
- P. Continue to specialization courses in the PLTW engineering pathway.

#### **Grading Procedures:**

A = 93-100      B = 85-92      C = 77-84      D = 70-76      F = Below 70

#### **Grading Procedure Percentage Breakdown:**

Students will be graded on classroom behavior, participation, homework, classwork, activities, projects, quizzes and tests. Percentage grades will be assigned based on each student's accumulated points compared to the total available points.

**A comprehensive PLTW end of course assessment will be taken by all students at the completion of the course.**

#### **Late Work:**

Late work is generally accepted with a one-time 10% reduction in credit (unless prior arrangements were made) until the end of the marking period in which the assignment was given.

#### **Online Course Access:**

Each student will have their own individual account to access the PLTW Learning Management System (LMS) where all course materials are available. The LMS is accessible anywhere students can connect to the internet.

**Course Topics:**

**Unit 1: Energy and Power** – Mechanisms and simple machines are explored focusing on the relationship between input and output forces. Energy types and sources and the conversion of energy will be investigated along with electrical circuits. Thermal conductivity will be examined and materials will be considered for their abilities to act as insulators or conductors. The unit concludes with the design and construction of a simulated renewable electrical energy distribution system.

**Unit 2: Materials and Structures** – Students will evaluate the internal distribution of forces through structural trusses and determine the external reactions required for static equilibrium. We'll build trusses, predict the failure mode, and destructively test the trusses to confirm or refine the predictions. After investigating statics, material properties will be explored. Students will be introduced to some of the basic material properties used in engineering. Recycling and disposal of materials after their useful life has ended will also be considered. Both destructive and non-destructive material testing will be used to find how engineers verify expected material properties and validate material manufacturing processes. Finally students will design their own bridge and will use testing software to virtually load test and optimize their design.

**Unit 3: Measurement and Statistics** – Computers control increasingly more devices and processes every day. We begin this unit learning to control mechanical processes using computer hardware and software. Students will then see how pneumatic and hydraulic power can also be used to control mechanical systems. The unit culminates with a design challenge in which students will design their own control system to solve a given problem.

**Unit 4: Modeling Skills** – Students will use statistical calculations to analyze data and will calculate the probability of simple and compound events occurring. Projectile motion will be explored and predicted using kinematics equations. The unit will conclude with student teams designing and building their own projectile launchers and performing statistical analysis to find their launchers' reliability.

**Classroom Expectations:**

1. Please come prepared for class each day:
  - **Each student should have a 1" (minimum) three ring binder dedicated to this class** to hold and organize class notes and work
  - **Bring a ball point pen (black or blue) and pencil to class every day.** We will be writing and/or sketching every day.
  - Homework will be assigned periodically and will be checked and graded for completion which includes showing all of your work.
  - **A personal scientific calculator will be helpful** but classroom calculators will be available.
2. Please come to class on time. All unexcused tardiness will be reported to the office in accordance with NHS policy.
3. Classroom interruptions will not be tolerated. We're all here to learn and work together to reach our course objectives.
4. Cell phone use will generally not be allowed in the classroom. I will specifically let you know if there are times when they may be used. Violations will be handled in accordance with NHS policy.
5. Eating is not allowed in my classroom. A clear, colorless water bottle is allowed in accordance with NHS policy.
6. Classes are short and time is precious. Any work time given in class is understood to be for POE work.
7. If you miss class, it is your responsibility to make up any missed work. Check with a classmate and/or the LMS to see what you missed. You will have as many days as you missed to make up work per school policy.
8. **If you need help, please ask.** I am generally available before and after school. We may also be able to find time during the school day. If you are making an honest effort, I will do my best to help you succeed.

Parent (print): \_\_\_\_\_ Sign: \_\_\_\_\_

Student (print): \_\_\_\_\_ Sign: \_\_\_\_\_