

# Principles of Engineering

## Overview

Principles Of Engineering (POE) is a sophomore-level survey of engineering course meant to be taken after Introduction to Engineering. The course continues to expose students to some of the major concepts that they will encounter in a postsecondary engineering course of study or in a technical career field. POE gives students the opportunity to develop skills and understanding of course concepts through activity-, project-, and problem-based (APPB) learning. Students will spend approximately 3 weeks exploring each discipline through concept lectures and hands-on projects. Through these lectures and projects students will learn concepts such as, but not limited to, electrical circuitry, Arduino-based computer programming, Rube Goldberg machines, biomechanics, and pneumatics/hydraulic systems. Students will work in teams to develop problem-solving skills and apply their knowledge of research and design to create solutions to various challenges. Students will also hone their 21st century skills by documenting their work and communicating their solutions to their peers and members of the professional community.

## Objectives

- Understanding and applying the engineering design process to solve problems
- Applying computational thinking skills to build and program an Arduino to successfully complete various projects
- Collaborating with team members to successfully solve problems and make design improvements
- Using effective oral, written, and technological communication to document the engineering design process.
- Understanding the various career paths available in each of the engineering disciplines and the various career paths available

## Assessment

Students will be assessed using projects, quizzes, and exams as well as a final project.

Equipment	Cost/Unit
General Supplies for projects	\$2500

## First Semester

Unit 1 – Engineering Design Process and Reverse Engineering	Take an object apart to understand how it works
Unit 2 – Civil Engineering	Hydraulic and Pneumatic Systems <b>Project: Hydraulic Drawbridge Design Challenge</b>
Unit 3 – Mechanical Engineering	Simple and Complex Machines, Mechanical Advantage <b>Project: Design a Rube Goldberg</b>
Unit 4 – Industrial Engineering	Workflow and Facility Planning, Efficiency, Quality Control, <b>Project: Design an Assembly Line</b>
Unit 5 – Electrical Engineering	Ohm's Law, Parallel and Series Circuits, Circuit Building on Arduino <b>Project: Infinity Gauntlet Challenge</b>

## Second Semester

Unit 6 – Computer Science	Functions, If Statements, Variables, Energy Savings <b>Project: Design a Programmable Thermostat Using Arduino</b>
Unit 7 – Chemical/Petroleum Engineering	Unit Operations, Process Flow Diagrams, Heat Transfer <b>Project: Create a Cajun Air Conditioner</b>
Unit 8 – Environmental Engineering	Sustainable Alternative Fuels, Environmental Trade Offs, Energy Calculations <b>Project: Wind/Solar/Hydro powered cell phone chargers</b>
Unit 9 – Biomedical Engineering	Functions of the nervous system, electrical impulse of muscles <b>Project: Myoware controlled robotic claw</b>
Unit 10 – Final project	Students choose an engineering “major” and find a project to work on



Gordon A. Cain Center

## PRINCIPLES OF ENGINEERING

### 1. Materials:

A desktop or laptop computer, access to 1-to-1 daily, and Internet. Chromebooks will not work with the free Arduino software.

Reusable Hardware/Material	Recommended Unit	Cost/Unit
Various reusable material and hardware for projects	1 per classroom	\$2,000
<b>Consumables</b>		
Various consumables for projects	1 per classroom	\$800
<b>Software</b>		
Arduino IDE	1 per student	Free on PC; \$1/month for Chromebook

\*Complete supply list with purchase links can be found [here](#).

### 2. Required software, networking access, and access to LSU servers

- Teachers will need to be able to share documents via Google drive with LSU Instructors.
- Arduino software will need to be installed on computers. Arduino software will need to be installed on computers. It is free to download on computers. There is a cloud based version that is also available but requires drivers to be downloaded. There is also a Chrome App that can be purchased for \$1/student per month (only required for one month). However, IT would have to install it on student chromebooks.

### 3. Required teacher collaborations

Teachers will communicate with LSU instructors via email and shared Google Drive folder.

### 4. Required administration of course content, pre/post test, and research instruments

All required materials and instruments will be either posted in a Google drive or their location announced via the Google group for this course.

### 5. Course Work

Teachers must present the course material in sequence or as approved by collaboration with the LSU Pathway Point-of-Contact. Teachers are expected to deliver a minimum of 80% of the course material.

### 6. Other

As this is a project-based learning class, we strongly suggest that each section of the course be limited to a *maximum* of 20 students. If the course is overloaded with students, they will not receive adequate instruction.

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