

Intro to Engineering 1-2

Course Syllabus 2021-2022 Instructor: Mr. Nick Fenger Contact: nfenger@pps.net Prerequisites: None	Curriculum: PPS Canvas LMS Grade Reporting: PPS Parent & StudentVUE Credit: 1.0 Elective and CTE Credit (Engineering Program of Study)
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Overview

The goal of this course is for students to gain an introductory understanding of various engineering disciplines and the iterative design process by designing and building their own projects as individuals and small teams.

The class culture is best described as “[Maker Culture](#)” (see Wikipedia page). In this classroom, students collaboratively create mechanical projects using a wide variety of digital design, modelling and simulation tools. In addition, students make their projects “come to life” using electronics (e.g. Arduino, Circuit Playground) that integrate electrical components and sensors.

To gain skills necessary for collaborative project work, students complete prerequisite self-paced learning modules that expose them to engineering concepts. These concepts include computer aided design, digital fabrication, microcontroller programming, basic electronics, and mechanical/structural design. The engineering content is intended as a starting point for students who have little or no experience. Curriculum add-ons and challenges are included for more advanced students.

Learning Outcomes

By the end of this course students learn the following hard skills:

1. Can create basic 2D sketches and 3D models using CAD (Computer Aided Design) software
2. Use manual tools and materials to form and assemble mechanical projects
3. Understand the principles digital fabrication using laser cutters and 3D printers
4. Export scaled models from CAD software and import them into 3D printers and laser cutters
5. Assemble electronic circuits necessary to connect microcontrollers to power, inputs and outputs
6. Program a microcontroller create “smart” projects that read inputs and sensors and control outputs

By the end of this course students learn the following soft skills:

1. Be able to break up a design problem into smaller tasks.
2. Develop a step-by-step plan to accomplish a goal.
3. Present ideas clearly and effectively.
4. Work effectively within a team.
5. Be able to revise the plan as needed to accomplish the goal.
6. Be able to reflect on the outcome to approach the next problem differently based on what has been learned.

Assessment

Students are formally assessed through their completion of background modules and by demonstrating competencies in project work. Students are offered many choices including, project focus, level of challenge, their teammates and role(s) in project work. The element of choice provides students unique experiences that differentiate them when applying for scholarships, internships, college, etc..

Students document their project work in a journal and reflect on their learning periodically. A final project report and documents the entire project with photos, narrated videos and brief written summaries describing their process. Project reports serve as documentation of student choices and their unique skills. Reflection on the outcome of their choices and collaboration with teammates in these reports is essential to the content of letters of recommendation.

Grading Policy and Philosophy:

This is a project-based course, because of this, the usual model of learning material and then demonstrating mastery in a final exam doesn't easily apply. In a project-based class there are multiple milestones students are expected to achieve throughout the project cycle. Students are asked to explain what they are doing, how they are doing it, etc. to the instructor. Students' academics are assessed and they are also asked to self-evaluate their progress at the completion of the project.

The specific objective measures of performance are:

1. **Achievement** which is a measurement of acquired skills through using tools, applying engineering concepts, and contributing in a team setting. This grade reflects what the student knows, understands, and can do at a given time relative to agreed upon goals. Achievement grades are reported throughout the term in Synergy and progress reports and solely define their grade on the official transcript.
2. **Habits of Mind** which is a measurement of the contribution a student makes to their own success. These included a student's perseverance, asking for help when needed, revising work to improve quality, setting and pursuing academic goals, accepting challenges and seeing issues from multiple perspectives. Habits of Mind grades are only reported in Canvas and aren't included in the calculation of a student's official grade in Synergy.
3. **Growth** which stems from evidence a student has or has not made measured progress toward agreed upon goals. Growth grades are only reported in Canvas and aren't included in the calculation of a student's official grade in Synergy.

Homework

While there may be an occasional reading assignment given in a handout, almost all of the work is done in-class. There may be times when students will have to put in extra time after school or during lunch to complete project hard deadlines.

Late Work Policy

For each assignment, students are given a "soft" and "hard" deadline. If students turn in a complete project by the soft deadline, they receive feedback on their project and gain the opportunity to make improvements. Projects submitted after the soft deadline may not receive feedback or a chance for improvements. Extenuating circumstances will be dealt with on a case by case basis through direct communication with the teacher.