

**Spaulding High School
Syllabus 2020-2021**

Course Title: Science of Engineering

Department: Science

Teacher Contact Information: Miss Sara Dorr (she/her)
sdorrshs@buusd.org (preferred)
(802) 476-4811 ext. 2112

Department Chair Contact Information: Samantha Mishkit
smishshs@buusd.org
(802) 476-4811 ext. 2111

Course Description:

Science of Engineering is a hands-on course for students who are curious about the science behind the technologies and infrastructure of our world. Students will explore concepts of movement, forces and renewable energy through project-based learning challenges. Our work will be completed in the style of the industry from problem analysis, to designing solutions to evaluating solutions for improvement. We will develop the skills necessary to be a contributing member of any design team: design thinking, collaboration, communication, preparedness and presenting work for a target audience.

For an optional honors credit, students may elect to complete additional learning tasks and projects that require a strong work ethic and mathematical skill-set. Some of this work will require independent or group work outside of scheduled class times. Students who plan to pursue a degree in engineering after high school are encouraged to complete the optional honors credit.

Topics addressed:

- Design Process
- Technical Sketching and Drawing
- Measurement and Statistics
- Modeling Skills
- Geometry of Design
- Reverse Engineering
- Advanced Computer Modeling
- Design Team
- Design Challenges

Required materials for each class:

- pen/pencil
- charged chromebook
- chromebook charger
- 3-ring binder (1.5" capacity minimum) - may be shared with other classes
- scientific or graphing calculator

Practice & learning tasks:

Students are expected to participate in all *Learning Tasks*. These may include:

- Class discussions
- Labs/activities
- Problem solving (computational thinking)
- Lecture and note taking
- Projects
- Investigations
- Practice sheets
- Entrance & exit cards

Assessment & Reassessment:

Students will be assessed on the *Performance Indicators*, listed below, to determine their mastery of the course *Standards*. Assessments may take the form of quizzes, projects, presentations or written work.

Once an assessment has been returned, students have the opportunity to reassess to demonstrate a higher level of proficiency. Reassessments might be more challenging and/or time consuming than the original assessment and may take a different format. To be eligible for reassessment, a student must meet with their teacher to create a plan to be successful in reassessment.

Optional Honors Credit:

Students who strive for depth and complexity in learning the course *Standards*, and who demonstrate a commitment to working hard and developing strong study skills may work towards an optional honors credit. If successful, the credit will appear on a student's transcript and the student will earn a +0.33 GPA boost.

To achieve the honors credit, a student must:

- Be willing and able to work outside of scheduled class time (i.e. homework)
- Have solid trigonometry and algebra skills (assuming completion of Algebra II)
- Turn in all assignments and assessments in a timely manner
- Complete honors extension work on learning tasks
- Show proficiency on all *Performance Indicators*
- Complete additional work on most *Performance Indicators*
- Complete all **optional honors** *Performance Indicators*

Classroom Expectations:

Come to class with an open mind and attitude of respect. Be kind to yourself, your peers and SHS staff.

We should **all** have a say in what our class community looks like. We will develop class norms together in the first weeks of the semester.

That said, it is my responsibility as the adult in the classroom to ensure a safe and productive learning environment for all students. If there are behaviors that endanger the safety of a student or their peers, disciplinary action will be taken.

Substitutes:

When I am absent from class, the class community norms should not change. Treat your substitute teacher with kindness and respect, while working diligently on your learning. I will ask the substitute if class norms were broken and will take disciplinary action if necessary.

Extra Help:

Extra help is available by appointment during AM Block Monday through Friday and during Academic Advisory time on Tuesdays through Fridays. If you are feeling like you need help, let me know in class or email me so we can schedule you for this time.

Progress Reports:

Every 3-weeks, you will receive a progress grade (Unsatisfactory, Below, or Meeting). To earn the progress grade of "Meeting," you need to be: caught up with work/assignments, meeting current due dates, and on track to pass the course. If you are not meeting these academic expectations, then you will be required to attend Office Hours where we will sit down and discuss what you need to do to get back on track.

Call Back day requirements:

At the end of the semester during Call Back Day, students who are close to passing will be allowed to make up no more than 2 *Performance Indicators*. If students did not consistently complete PAS tasks and meet PAS expectations, then they may be ineligible for Call Back.

Grading:

We will use Spaulding High School's proficiency grading scale to assess students's learning in both *Performance Indicators* and *Standards*.

IE Insufficient Evidence (0)	B Beginning (1)	D Developing (2)	P Proficient (3)	E Exemplary (4)
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Standard Scoring:

The Standard scores are determined based on the Indicator scores.

→ To earn **Proficient (P)** in a standard the majority of the *Performance Indicators* need to be P or Exemplary (E) and there cannot be any Insufficient Evidence (IE).

→ To earn **Exemplary (E)** in a standard the majority of indicators need to be Exemplary and no *Performance Indicators* can be below Proficient (P).

**(This means you cannot have Beginning or Developing on any Performance Indicators)*

Course Scoring:

The course grade is determined based on the Standard scores. Use the [Course Performance Grading Outline](#)* to determine your overall grade for the course.



** To earn Partial Exemplary for the course, you cannot have any B's, but can have up to 3 D's on Performance Indicators in separate Standards.*

Science of Engineering Assessed Course Standards:

Standard #1: Problem Analysis

Performance Indicators: Student's will be able to...

- 1.1 ... Identify and define a problem
- 1.2 ... Identify stakeholders and define stakeholder goals
- 1.3 ... Specify qualitative criteria and constraints for solution
- 1.4 ... Specify quantitative criteria and constraints for solution
- 1.5 ... Define a timeline

Standard #2: Designing Solutions

Performance Indicators: Student's will be able to...

- 2.1 ... Break complex problems into smaller solvable sub-problems
- 2.2 ... Research potential solutions and critically evaluate
- 2.3 ... Brainstorm a variety of solutions
- 2.4 ... Use industry-standard drawing and modeling techniques in solution design
- 2.5 ... Build and test prototypes

Standard #3: Evaluating Solutions

Performance Indicators: Student's will be able to...

- 3.1 ... Identify benefits and limitations of solutions
- 3.2 ... Weigh solutions against defined criteria and constraints (cost, safety, reliability, aesthetics)
- 3.3 ... Consider and evaluate possible impacts (environmental, social, cultural)
- 3.4 ... Reflect on preliminary design and give constructive feedback for improvement through iteration
- 3.5 ... Present a rationalized compelling argument for your selected solution

Standard #4: Professionalism

Performance Indicators: Student's will be able to...

- 5.1 ... document and justify thinking processes
- 5.2 ... collaborate & communicate effectively with teammates & stakeholders
- 5.3 ... consistently present completed projects at specified deadlines
- 5.4 ... demonstrate an understanding of possible career pathways in STEM

Standard #5: Optional Honors

Performance Indicators: Student's will be able to...

- OH6.1 ... solve multi-faceted engineering problems using systems of equations
- OH6.2 ... use basic computer coding techniques to solve a problem
- OH6.3 ... use spreadsheets as mathematical tools to analyze and interpret data

Spaulding High School Science Safety Contract

Science investigations allow students to learn science through discovery. Many investigations utilize equipment and chemicals that must be used safely and responsibly. Science teachers will assure that you have a safe laboratory experience, but you must also do your part. Read the following safety contract. Signing the contract signifies you understand and will follow it. A parent or guardian must also sign so everyone is committed to safe laboratory practices.

1. Follow all written and verbal instructions as directed by the teacher.
2. Never attempt unauthorized experiments. Do laboratory work only when the teacher is present.
3. Keep the work area clear of everything except laboratory materials.
4. Food and drink is not allowed in the laboratory area. Do not chew gum. When using chemicals or preserved specimens, keep hands away from face, eyes, mouth, and body.
5. Students are not permitted in any chemical storage room.
6. Never run in the laboratory. To prevent accidents, be aware of your environment at all times.
7. Your teacher will describe the location of exits and all safety equipment. Know where the closest fire alarm is located.
8. Use equipment (balances, Bunsen burner, etc.) in the correct way, as instructed by the teacher.
9. Properly dispose of broken glassware and other sharp objects in designated areas.
10. Any time chemicals, heat or glassware are used, students, teachers, and visitors will use laboratory goggles. Lab aprons must be used when there is danger of chemical spills or biological contamination.
11. Long hair must be tied back and dangling jewelry and baggy clothing are not appropriate. Shoelaces must be tied and sandals are not allowed.
12. Immediately report any spills, accidents, or injuries to the teacher.
13. If a chemical splashes in your eye(s) or on your skin, flush with water. Inform the teacher immediately.
14. Never touch, taste, or smell chemicals or other substances unless directed to do so.
15. Follow all provided instructions when handling chemicals.
16. Follow all provided instructions when handling glassware, equipment, and when heating substances.
17. Never point the open end of a test tube containing any substance at yourself or others.
18. Dispose of all chemical and biological waste properly. The teacher will tell what materials can be poured down the drain and what materials must be placed in a waste container.
19. Clean all work surfaces and equipment at the end of laboratory work and return all equipment to the proper storage area.
20. Wash your hands with soap and water after performing all investigations and before you leave the laboratory area.
21. If you are unclear or confused about proper safety procedures and/or laboratory instructions, ask the teacher before proceeding.

ADDITIONAL, SPECIFIC INSTRUCTIONS WILL BE GIVEN PRIOR TO LABORATORY ACTIVITIES.

Student Signature: _____

Date: _____