JOHNS HOPKINS
WHITING SCHOOL
of ENGINEERING

Syllabus

EN.800.109 Explore Engineering Innovation, Summer 2025

Contents

About the Course 1
Teaching Team 2
Schedule 2
Access 3
Communication 5
Grading 5
Major Deliverables 7
Policies 10

About the Course

Description

Explore Engineering Innovation (EEI) is an exciting college-level summer program for motivated high school students with an aptitude in math and science and an interest in (or curiosity about) engineering. This program has been available to high school students since 2006. In the program, students learn to think and problem-solve like engineers and have the opportunity to earn Johns Hopkins University (JHU) credit.

This is a course of lectures, laboratories, and special projects. Its objective is to introduce students not only to different fields of engineering, but also to the analytic tools and techniques that the profession uses. Assignments include hands-on and virtual experiments, oral presentations of product design, and design/construction/testing of structures.

For more information, visit https://ei.jhu.edu.

Prerequisites

- High school algebra II and trigonometry
- High school chemistry or physics
- As and Bs in high school math and science courses

Objectives

- To introduce students to prevalent topics in engineering
- To prepare students for rigorous college engineering programs
- To help students develop problem solving strategies and confidence
- To assist students in determining whether engineering is a career they are interested in pursuing

Modules

- Chemical Processes
- Data Analysis
- Engineering Design and Technical Communication
- Ethics
- Finance
- Introduction to Electronics and Coding
- Materials
- Statics

Textbook and Lab Kit

This course does not have a textbook. All course materials are found on the course Canvas site or Microsoft Teams.

The materials you will need for hands-on projects are available in the Explore Engineering Innovation lab kit available for purchase from Quality Science Labs. Please order your lab kit as soon as possible if you have not already, as you will need materials from the lab kit as soon as the course starts. If you have issues ordering your lab kit, please contact the Engineering Innovation office at ei@jhu.edu. If you will be travelling during the course of the program, please look ahead to the work you will be doing while away and bring any necessary lab materials with you.

Teaching Team

The course is taught by an instructor with support from a teaching fellow (TF) and possibly a teaching assistant (TA). Teacher biographies and contact information can be found in Canvas under the Getting Started module.

While your teachers will not be "on call" for the course, they will make every effort to respond to your questions and reply in a timely fashion. Once the course begins, **please make every effort to contact your teachers through Microsoft Teams rather than email**.

Schedule

You should expect to spend 5 ½ hours per weekday on this course:

- Self-study: Each day begins with approximately 1 hour of independent work to cover new material. This includes watching pre-recorded lectures, reading, and solving simple practice problems. You should complete this work on their own time.
- Synchronous 3-hour class meeting: The second block of time is 2 ½ hours of work during the synchronous 3-hour session that was assigned during course enrollment. You will work for three blocks of 50 minutes with 15-minute breaks in between. Most of this time is spent working in small groups.
- Homework: The day ends with a homework assignment that is designed to take 1 ½ hours to complete. This work may be independent or group work.

A calendar with due dates is available in the Calendar area of the Canvas course menu. Unless otherwise noted, **all homework must be submitted to Canvas before the next synchronous class meeting begins.**

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Access

Required Software

You will need access to a computer with the following capabilities:

- Access to a spreadsheet application, which will allow you to analyze data*
- Access to a word processing program that can be used to write your course lab reports*
- Access to a presentation program, so you can create a presentation for their final project*
- Ability to upload videos to the internet
- USB port to communicate with the Adafruit Circuit Playground Express
- Reliable internet access

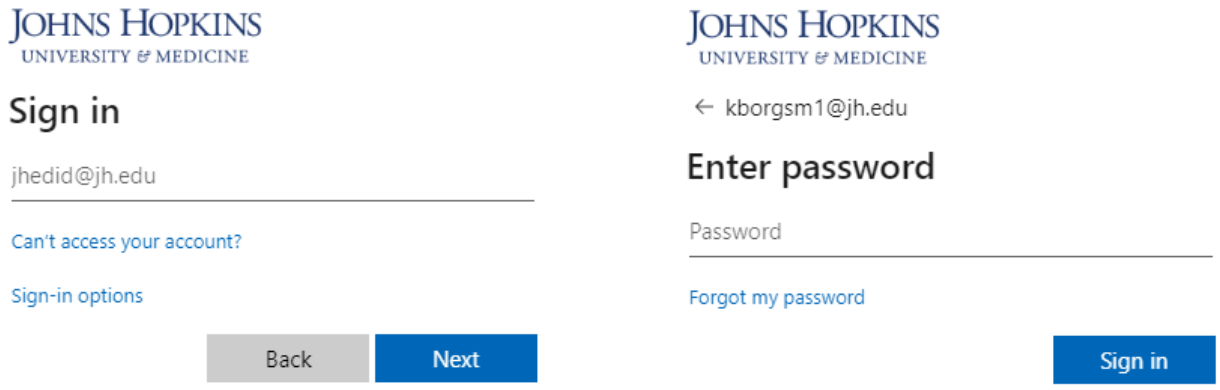
*All students are granted a Microsoft Office 365 license during the program.

Johns Hopkins Online Account

The Johns Hopkins Enterprise Directory (JHED) system is an online, comprehensive source of contact information for Johns Hopkins University faculty, staff, and students that grants access to the following resources:

- Canvas – access the course files
- Microsoft Teams – communicate with the class
- Microsoft Office 365 – access Word, Excel, PowerPoint, OneDrive, etc.
- myJHU – view and update your student profile
- SIS – view your final grade at the end of the course
- Library – access online reference materials

Sign into these applications using JHEDID@jh.edu (**NOT @jhu.edu**) and your password.



New students should receive an email from the registrar containing their JHED ID shortly after enrollment. Instructions for activating the account are provided in the Online Account Activation Instructions Form during course enrollment. Contact webregistration@jhu.edu or call 410-516-8080 for assistance, if needed.

Canvas – Course Materials

All course materials will be provided through Canvas (canvas.jhu.edu). Sign into Canvas using your JHEDID@jh.edu (**NOT @jhu.edu**) username and password. . If you have difficulty logging in or accessing the course on Canvas, please contact the Help Desk at cmtshelp@jhu.edu .

The course materials are divided into modules, which can be accessed by clicking Modules on the Canvas course menu. A module will have several sections including the overview, lecture videos, discussions, and assignments. You will have access to the Canvas site for one month following the last day of class.

Microsoft Teams –Communication

This course will use Microsoft Teams for communication, including the daily synchronous class meeting. This is a platform that works in your browser, on your desktop, and has an app for tablet and phone (iOS and Android), so you can participate from whatever device you are most comfortable. To access Teams in a browser, navigate to https://teams.microsoft.com.

Sign in with your JHU email using @jh.edu (**NOT @jhu.edu**) and JHU password. Your course Team will not be visible until the Saturday before the first day of class.

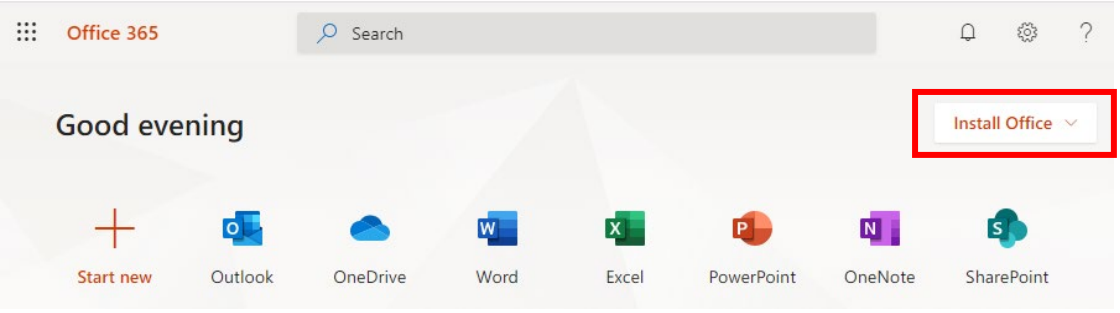
There are a few channels to organize discussion by topic. To customize your channel notifications, click the dots next to the channel name and select Channel notifications. You can also customize your notifications by going to Settings > Notifications (in desktop/browser, click your initials in the upper right-hand corner to find the Settings menu). Teams has many different notifications on its different platforms, so make sure you have them configured to get the communications you need.

For more information, check out the Microsoft Support information for getting started with Microsoft Teams. If you have difficulty logging in or accessing Microsoft Teams, please contact the Help Desk at cmtshelp@jhu.edu.

Microsoft Office 365 Software

While you are enrolled in the course, you will have access to the software included in the Microsoft Office 365 Suite such as Microsoft Word, PowerPoint, and Excel. You will need your JHED to download the software to your device.

- Go to https://www.office.com and click Sign In.
- Sign in using JHEDID@jh.edu (**NOT @jhu.edu**) and your password.
- When you land on the Office.com home screen, you can click Install Office in the upper right corner. Installing the software is optional; you can also use the web versions directly in the browser.



Communication

Course Announcements

Important announcements will be posted to Microsoft Teams in the General channel. They may also be cross posted in the relevant module channel. You should check for new announcements each day.

Public Questions via Teams Channels

Questions about the course should be posted in Microsoft Teams. Please refrain from sending private messages to your teachers about general course questions. Instead, ask questions in Microsoft Teams channels as much as possible so that the entire class can benefit from reading the answer. Your classmates might even know the answer to your question and respond to you before a teacher does! Students can post replies to questions from their peers, and this behavior is encouraged! In addition to written replies, it's also helpful to "like" posts by clicking on a post then selecting the thumbs-up icon.

Personal Questions via Teams Chat

Direct chat messaging should be reserved for content that is not relevant to the whole class (late assignment, accommodations, etc.). To start a chat group with your teaching team, select Chat on the left-hand menu of Teams and click the New Chat icon () above the chat list pane. Type in the names of all your teachers to add them to the group. **Please refrain from chatting with an individual teacher; instead, chat with the whole teaching team.**

Interacting with Peers

You are encouraged to discuss the course content with your peers. In addition to posting and replying to messages in the public Microsoft Teams channels, you can also use Microsoft Teams to chat with individual students or groups of students.

Be respectful and reach out to a teacher if you believe someone is behaving inappropriately. Recall that you are bound by the Academic Integrity policy for the duration of this course.

Grading

Submission Format

Documents should be submitted in PDF format. Videos should be created as .mp4 or .mov format, uploaded to Microsoft Stream, and shared via a link to the video.

Typed submissions are preferred, but handwritten work can be scanned or photographed and included within a Word document. One option is to use a program like CamScanner to digitize handwritten work. Please take the time to ensure scans are not blurry, handwriting is legible, pictures are not sideways, and text and photos are not too small.

Late Policy

Unless otherwise noted, **all homework submissions are due at the start of class**. Do not wait until the last minute to upload your work to Canvas! Large video files may take an hour or more to upload.

Because this course moves at a fast pace, submitting work late is problematic. Often, feedback received on an earlier assignment can be used to improve your work on later assignments, so receiving delayed feedback can have downstream effects. Care has been taken to ensure all due dates allow time for you to attempt the assignment and ask questions if needed. After that, a 50% late penalty will be applied every day the assignment is late. Exceptions can be made for genuine hardships experienced during the course, so please contact your teaching team as soon as possible to let them know why an assignment is or will be late if you believe you should get an exception.

Grade Questions and Regrade Policy

You may submit work to be regraded if you feel there is an error in how it was graded. Requests should be made via Teams chat with the teaching team within 48 hours of the grade being posted in Canvas. You should indicate what portion of the work should be regraded and explain the rationale for your request. The new grade may be higher, the same, or lower than the original grade. Once work is regraded, it may not be submitted for another regrading analysis.

Group Work

Engineering is often collaborative, and, as such, many of your labs and projects will be conducted in a group. Generally, everyone in the group will earn the same grade on the assignment unless otherwise noted. However, if it is suspected that a group member contributed significantly less than the others, their grade may be adjusted individually after a conversation between the instructor and group members.

Grade Calculation

Final grades will be determined by the following weighting:

Item	% of Grade
Projects	65%
Assignments	20%
Quizzes	5%
Class Participation	10%
TOTAL	100%

Final Grade Letters

Your grading scheme—chosen at the time of enrollment—is either a Letter Grade or Satisfactory/Unsatisfactory Grade. You can switch grading schemes by submitting a request to the Registrar on or before the deadline. The deadline for Summer 2024 is July 24.

The final grade letter or S/U is based on the final grade percentage according to the table below.

Letter Grade	S/U Grade
97% ≤ A+ 93% ≤ A < 97% 90% ≤ A- < 93% 87% ≤ B+< 90% 83% ≤ B < 87% 80% ≤ B- < 83% 77% ≤ C+< 80% 73% ≤ C < 77% 70% ≤ C- < 73% 67% ≤ D+< 70% 63% ≤ D < 67% F < 63%	Satisfactory (S): 70% and above Unsatisfactory (U): Below 70%

Major Deliverables

Spaghetti Bridge Project

You will test the material properties of spaghetti and use truss analysis (statics) to design, build, and test a bridge made of spaghetti and epoxy.

The deliverables for the Materials labs are written lab reports. You will use provided data to complete a lab report for tension, then you will collect data and complete a lab report for bending. Finally, you will write the experimental methods, collect data, and complete a lab report for buckling.

The deliverable for the individual bridge design and build is your choice of either a poster, a written report, or a video presentation.

The points for this project are allocated as follows:

- 200 pts – Materials labs (tension, bending, and buckling)
- 100 pts – Group bridge design
- 100 pts – Individual bridge design, build, and test

In total, deliverables for the Spaghetti Bridge Project are worth 400 points. Projects completed as part of this course are not considered independent research and do not meet the threshold for publication.

Electronics Project

You will use MakeCode block programming, JavaScript, or CircuitPython to control a Circuit Playground Express (a programmable circuit board with built-in sensors, buttons, and lights). After working in a group to build a memory game, you will be given a design challenge: build a device that will help the user live a healthier life. Emphasis is placed on transferable skills like defining the problem, writing use cases, debugging, developing verification procedures, and creating documentation.

The deliverables for the individual design challenge are the code, a user guide, and a demonstration video. Projects are then peer reviewed.

The points for this project are allocated as follows:

- 125 pts – Group project
- 145 pts – Individual project (code, user guide, demonstration video)
- 30 pts – Peer review

In total, deliverables for the Electronics Project are worth 300 points.

Chemical Processes Project

You will design an experiment to convert cornstarch to sugar using amylase enzyme. During this process you will calculate the percent conversion and the energy efficiency of the heating element. The Chemical Processes Project is worth up to 160 points.

Request for Proposal Project

You will work in teams to imagine a new product or service in response to one of several Requests for Proposals (RFPs). Your group will create a PowerPoint presentation to pitch the idea to your peers. This is an exercise in technical communication, finance, and the engineering design process. The Request for Proposal Project is worth up to 140 points.

Mousetrap Project

You will design a paper mousetrap and create instructions for how to build it. A classmate will then attempt to recreate the device by following the instructions and provide feedback on your design or instructions. This is an exercise in the engineering design process and technical communication. The Mousetrap Design is worth 70 points and the Mousetrap Build is worth 50 points, for a total of up to 120 points.

Ethics Project

You will learn about the National Society of Professional Engineers' (NSPE) code of ethics and apply it to one of several case studies. You will read one or two provided articles, respond to short-answer questions, and construct an argument for peer review. The Ethics Project is worth up to 120 points.

Assignments

Assignments are questions or activities designed to give you practice with the course content. You should complete assignments on your own, not in a group.

Assignment links are provided in the corresponding Canvas modules. You are required to submit your work to Canvas as a PDF file. All work must be shown and legible to earn full credit. Solutions without justification will not be considered complete and the grade will be adjusted down accordingly.

Each of the following assignments is worth 40 points:

- Units and Dimensions Assignment
- Excel Assignment
- Error and Uncertainty Assignment

- Statics Assignment
- Finance Assignment
- Chemical Processes Assignment

Quizzes

Each module includes quizzes composed of multiple choice and fill-in-the blank style questions. You should complete quizzes on your own, not in a group.

Quiz links are provided in the corresponding Canvas modules. The quizzes are designed to test the concepts and skills covered in the module lectures, so you should plan to complete all lectures and readings before attempting the quiz. Quizzes are untimed, and you can attempt each quiz up to 2 times. Feedback on the quiz will be available after the quiz due date.

Each of the following quizzes is worth 20 points:

- Engineering Design Quiz
- Units and Dimensions Quiz
- Technical Communication Quiz
- Excel Quiz
- Materials 1 Quiz
- Materials 2 Quiz
- Materials 3 Quiz
- Error and Uncertainty Quiz
- Ethics Quiz
- Statics 1 Quiz
- Statics 2 Quiz
- Finance Quiz
- Electronics 1 Quiz
- Electronics 2 Quiz
- Chemical Processes Quiz

Reflection Survey Quizzes
The four modules with big labs/projects also include reflection surveys for you to reflect on how your work went and what you might do differently if you did the assignment again. The surveys are untimed, and you are automatically given the points for completing them.

Each of the following surveys is worth 5 points:

- Chemical Processes Lab Reflection
- Electronic Reflection
- Materials Reflection
- Statics Reflection

Class Participation

The class will meet for a synchronous three-hour session every weekday. Most of this time will be spent working in small groups to complete projects, conduct discussions, or solve engineering challenge questions. All students are expected to participate in the activities.

Participation is worth 12 points for each of the 24 meeting days. The lowest participation grade will be dropped, so the highest 23 participation grades will count toward the final grade for a total of 276 possible points.

Policies

Surveys

The Engineering Innovation office hires an external evaluator to assess the strengths and weaknesses of this course. Student feedback is essential to that process. Survey responses are anonymous; neither the teaching team nor the Engineering Innovation office can match students to survey responses.

A pre-course survey will be sent by email on or about the first day of class. A post-course survey will be sent by email during the last week of class. In addition, there are anonymous weekly surveys that are available in Canvas. Your participation is voluntary.

Academic Integrity

All students are required to read, know, and comply with the Procedures for Dealing with Issues of Academic Misconduct as detailed in the enrollment form you signed.

This policy prohibits academic misconduct, including but not limited to the following: cheating, plagiarism, submitting the same or substantially similar work to satisfy the requirements of more than one course without permission, submitting as one's own the same or substantially similar work of another, knowingly furnishing false information to any agent of the University for inclusion in academic record, falsification, forgery, alteration, destruction or misuse of official University documents or seal.

While we encourage you to collaborate with your fellow students, all work submitted must be fully your own. Lab reports, assignments, quizzes, and projects must be done on your own. Direct copying of written work or computer code is considered cheating and will result in a grade of zero on the assignment and could result in failing the course.

Plagiarism is defined as taking the words, ideas, or thoughts of another and representing them as one's own. If you use the words of another, present the words in the correct quotation notation (indentation or enclosed in quotation marks, as appropriate) and include a complete citation to the source.

For the full Academic Misconduct policy, see the Pre-Collegiate Programs Academic Ethics Policy and Procedures.

Generative Artificial Intelligence (AI) Tools

Use of generative artificial intelligence (AI) tools such as Bard and ChatGPT can augment learning experiences when used appropriately. You may use generative AI to brainstorm and refine ideas, find reliable sources, outline, check grammar, and format bibliographies. You should note, however, that the material generated by these programs may be inaccurate, incomplete, biased, or otherwise problematic. You are ultimately responsible for what you submit.

Use your interaction with AI as a learning experience. Then, let your submitted work reflect your improved understanding. All writing and calculations you submit must be your own. Beyond bibliographies, you are not allowed to copy and paste material generated by AI and use it in your submitted work. Including AI-written content in any part of your submitted work will be considered academic misconduct.

Disability Services

Johns Hopkins University and the Engineering Innovation program are committed to making all courses, support services, and facilities accessible to students with disabilities. If you will need disability related accommodations, you will need to start the process of requesting accommodations with the Student Disability Services (SDS) and provide documentation of your disability as well as your need for accommodations. It is recommended that Engineering Innovation students complete this step as early as possible to ensure there is time to request and implement accommodations..

Learn about how to get started with student disability services and/or contact Student Disability Services for more information.

Discrimination and Harassment

JHU will not tolerate harassment, sexual harassment (including sexual violence), discrimination or retaliation in the workplace or educational environment whether committed by managers, faculty, administrators, staff, or students, or by visitors to our institution of higher learning. If you are a victim of any such situation, you are strongly encouraged to file a complaint through official university channels.

You may reach out to the Engineering Innovation office at ei@jhu.edu or submit a Discrimination and Harassment Report Form to the JHU Office of Institutional Equity.