

ENGR 16200 – Spring 2023

Honors Introduction to Innovation and the Physical Science of Engineering Design II (4 credits)

Course Information:

Sections H11/H12 (CRN 15543/15548): MWF, 9:30 am – 11:20 am; Shreve C-111; “Section 1”
Sections H03/H04 (CRN 21127/14391): MWF, 9:30 am – 11:20 am; Lambertus 5237; “Section 2”
Sections H13/H14 (CRN 15546/15550): MWF, 11:30 am – 1:20 pm; Shreve C-111; “Section 3”
Sections H07/H08 (CRN 28571/14393): MWF, 1:30 pm – 3:20 pm; Lambertus 5237; “Section 4”
Sections H09/H10 (CRN 14385/14394): MWF, 3:30 pm – 5:20 pm; Lambertus 5237; “Section 5”
Instructional Modality: Face-to-Face

Note: Purdue section designations for this class are indicated at the left of each line above. On the right of each line, in quotes, are the informal section designations that will be used by the Instructional Team.

Course Prerequisites:

ENGR 16100; grade of C- or better. Also, enrollment in this course requires prior admission to both the First-Year Engineering program (or the Pre-Agricultural and Biological Engineering program) and the Honors College or the Goss Scholars Learning Community.

Instructor Contact Information:

- Dr. Sean Brophy (sbrophy@purdue.edu): ARMS 1309; 496-3316
- Dr. Joseph Lyon (lyonj@purdue.edu): LMBS 2277; 496-2653
- Dr. Timothy Whalen (whalen@purdue.edu): LMBS 2275; 494-4473

Note: all office hours with instructors are by appointment. The best way to set up an appointment is to send an email to your instructor at the address listed above. In your email, please provide 2 or 3 suggestions for blocks of time for which you would be available for an appointment.

Graduate Teaching Assistant Contact Information:

- Aaron Guo: guo484@purdue.edu (Section 1)
- Andy Wilcox: wilcox64@purdue.edu (Section 1)
- Jose Ortiz Flores: jortizfl@purdue.edu (Section 2)
- Cody Waldecker: cwaldeck@purdue.edu (Section 3)
- Grigori Rudakov: grudakov@purdue.edu (Section 4)
- Dhruv Jain: jain220@purdue.edu (Section 5)

Course Office Hours:

Mondays, 5:30-7:30 pm, [online](#)

Tuesdays, 6:30-8:30 pm, [in-person \(SHRV C-111\)](#)

Wednesdays, 5:30-8:30 pm, [in-person \(SHRV C-111\)](#)

Wednesdays, 6:30-8:30 pm, [online](#)

Thursdays, 4:30-8:30 pm, [in-person \(SHRV C-111\)](#)

Thursdays, 4:30-8:30 pm, [online](#)

Course Objectives:

Students will take an in-depth and holistic approach to integrating multiple discipline perspectives while constructing innovative engineering solutions to open-ended problems. Students continue to explore more complicated models of physical systems, especially internal energy, entropy, models of gases and fluids, and statistical thermodynamics. Students will extend the concepts learned in ENGR 16100 and continue to develop skills in project management, engineering fundamentals, oral and graphical communication, logical thinking, teamwork, and modern engineering tools (e.g., MATLAB and Python). In addition, students will learn how to use hypothesis testing to make informed, quantitative decisions. Finally, they will build systems that incorporate feedback control to characterize behaviors of physical systems. Successful completion of this course will enable the student to:

- Utilize knowledge of the engineering education process, courses, options, and engineering job functions and roles to prepare a final course of study for academic and career success.
- Develop a unified approach to microscopic and macroscopic behavior of gases and fluids, especially the use of statistics and quantized atomic levels to motivate basic thermodynamic theories.
- Apply the unified approach to material interactions to a broad array of applications including astronomical objects, nuclear fission and fusion, quantization in atoms and molecules, and heat capacity.
- Model natural phenomena using computer simulations.
- Integrate engineering ethics, including social, safety, and sustainability issues into engineering thinking and engineering problem solving so that the broader impacts of engineering work are evaluated and accounted for.
- Display proficiency in the applications of engineering content knowledge including statistics, feedback control, and rigid body dynamics.
- Employ academic and career success strategies including managing your personal learning approach, using time management techniques, and seeking opportunities for self-improvement to thoughtfully pursue course activities and the course as a whole.
- Plan and implement systematic design processes using formal project management and design tools such as work breakdown structures and Quality Functional Deployment (QFD) methods to design innovative products and systems.

- Investigate and decompose systems to design and construct mathematical or computer models that can be employed to better understand or control the systems.
- Analyze and translate problems into algorithms composed of logical constructs and be able to create programming-language-independent system charts and flow diagrams embodying those algorithms.
- Demonstrate professional communications skills in the areas of technical writing, presentations, and interpersonal communication, to produce engineering reports, convey engineering findings and evidence in writing, verbally, and graphically to readers or audiences, and to work with other members of the class.
- Work alongside individuals with diverse backgrounds in teams, learn interdependently in the team environment, give and demand accountability, and accomplish engineering tasks, while recognizing teaming as an open-ended problem that needs to be actively managed and reflected upon.
- Investigate engineering problems to reach evidence-based conclusions, drawing upon one or more sources of information and data interpretation skills including interpolation, regression, curve fitting, statistics, and data cleaning.
- Apply fundamental engineering skills and knowledge relating to units, dimensions, estimation, spatial reasoning, graphical representation, significant digits, and the problem presentation method to engineering applications.

COURSE EXPECTATIONS:

You are expected to:

- Be an active contributor to in-class discussion and problem-solving activities.
- Be prepared and accountable for class by reading any assigned material ahead of time and be able to answer questions related to this material.
- Be held accountable for all material in reading assignments, course documents, electronic communications, and other sources of course information, regardless of whether the material is explicitly discussed in class or not.
- Attend class because of a community expectation to learn from each other.
- Be cooperative with your team and work with them, not compete against them.
- Learn interdependently with your team and your peers.
- Learn to be accountable to your team and have your team be accountable to you.
- Be prepared to meet with your team outside of class to complete assignments.
- Rely on your peers, as well as the instructional team, to learn the course material.

COURSE GRADE COMPUTATION:

3 Midterm Exams; each worth 14%	42%
Homework	17%
Ready Assessment Trials (RAT's)	2%
Checks for Understanding (CFU's)	8%
Design Challenges and Lab Activities	3%
Project 1	2%
Project 2	9%

Project 3

17%

Total

100%

COURSE GRADE COMPUTATION NOTES:

This course will make extensive use of student teams. As such, homework, activities, ready assessment trials (RAT's), checks for understanding (CFU's), and project grades may reflect some combination, in part or as a whole, of your individual effort and teamwork. Exam grades will, in their entirety, represent your individual understanding of the course material. In general, your final course grade will consist of approximately 70% of your own individual contributions. You are reminded that learning team accountability (your accountability to the team and the team's accountability to you) is an essential element of this course. As such, the course instructor reserves the right to use: materials submitted by your team to reflect your individual effort in the form of a grade; materials submitted by individuals to reflect your team's effort in the form of a grade; materials randomly collected by individuals to reflect your team's effort in the form of a grade; the weakest material submitted by individuals to reflect your team's effort in the form of a grade; or materials submitted by pairs of team members to reflect your individual or team effort in the form of a grade.

The following grading scale will be used to determine your semester course grade:

$90\% \leq A < 100\%$, $80\% \leq B < 90\%$, $70\% \leq C < 80\%$, $60\% \leq D < 70\%$, and $F < 60\%$

You are, at a minimum, guaranteed a letter grade for the course that corresponds to your course grade percentage as determined by the course grade computation (see above). However, the course instructor reserves the right to review a borderline student on a case-by-case basis. Factors that may be used to evaluate such cases may include: class attendance, participation, teaming, grade improvement, consistent homework completion, bonus completion, and the like.

In keeping with university regulations, students will be provided graded feedback before the end of the 8th week of classes.

REQUIRED TEXT BOOK:

There is no required textbook to be purchased for this course. Reading assignments will be made available online or distributed to students in class during the course.

OTHER REFERENCE MATERIALS:

These materials are references that you may wish to consider:

- Programming in Python 3, 2nd Edition
Author: Summerfield
Publisher: Addison Wesley
ISBN 978-0-321-68056-3

- Introduction to MATLAB 7 for Engineers, 3rd Edition
Author: Palm
Publisher: McGraw-Hill Higher Education
ISBN: 978-0-07-353487-9
- MATLAB Student Version – Recommend the basic edition. Additional tools we will employ can be found in the ‘Statistics and Machine Learning’ toolbox. Students may opt for the full ‘MATLAB Suite’ which includes Simulink, a tool for advanced modeling and system analysis. Many engineering majors make substantial use of Simulink and toolboxes beyond the basic edition.

IMPORTANT DATES: (EXAM AND PROJECT DATES ARE TENTATIVE)

January 9 – Classes start

January 13 – Release Project 1

January 16 – MLK Day (no classes)

January 25 – Project 1 Demonstrations (evening)

January 27 – Project 1 Executive Summary to be submitted electronically

January 30—Release Project 3

February 13 – Exam 1

March 6 – Release Project 2

March 8 – Exam 2

March 13 - 17 – Spring Break (no classes)

March 29 – Project 2 Presentations

March 31 – Project 2 Report to be submitted electronically

April 17 – Exam 3

April 24 – Project 3 Demonstrations (evening)

April 26 – Project 3 Presentations

April 28 – Project 3 Report to be submitted electronically

April 29 – Last day of all Spring classes

Campus Emergencies

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email. You are expected to read your @purdue.edu email on a frequent basis.

Attendance:

As indicated in the Course Expectations, you are expected to attend ALL classes. In the current context of COVID-19, students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have

been exposed to the virus. Students should also contact their instructor (not Grad TA or Peer TA) to make the instructor aware of the situation and discuss further steps as needed.

In keeping with Purdue's Class Attendance and Absence Reporting Policy (see <http://www.purdue.edu/odos/services/classabsence.php>), only your instructor can excuse you from classes or course responsibilities; no one else has this authority. For this course, excusable absences are limited to: documented illness; extended absences as documented by the Office of the Dean of Students; or Purdue sponsored events (e.g., conferences, club activities, varsity athletics, etc.) that do not conflict with an exam. Other situations (e.g., interviews, religious observances, personal events, etc.) may be excused at the discretion of your instructor. Be aware that having grounds for an excusable absence does not necessarily guarantee that you will obtain instructor permission to miss class or course responsibilities.

In the case of foreseeable events (e.g., Purdue sanctioned events with known dates, scheduled medical procedures, etc.), students are expected to provide appropriate documentation of the event prior to its occurrence with sufficient time for the instructor to make a decision about the suitability of the absence. In particular, if the event is Purdue sanctioned, students should have a person in authority with respect to this event send a request to your instructor to excuse the absence. In general, the person in authority should be a member of the faculty, staff, or administration; however, requests from other persons will be considered on a case-by-case basis. Instructors reserve the right to decline to excuse an absence, with the understanding that such a decision must be consistent with the Purdue policy referenced above.

In all cases where a student is requesting an excused absence, the student is expected to make a good faith effort to notify the course instructor in a timely fashion (prior to a class is considered timely, after the fact is generally not unless there are extenuating circumstances). The instructor may request further documentation to corroborate your request. Once an absence is approved, you will have one week to arrange with your GTA, through your course instructor, a means for making up any material you missed.

When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via email at odos@purdue.edu or phone at 765-494-1747.

Please note: students having an excessive number of unexcused absences (defined as more than 10% of the regularly scheduled class meetings) will automatically be dropped one letter grade regardless of their class standing.

Classroom Guidance Regarding Protect Purdue

The Protect Purdue Plan (<https://protect.purdue.edu/plan/>), which includes the Protect Purdue Pledge (<https://protect.purdue.edu/pledge/>) is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask in classrooms and campus buildings at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also the Purdue University Bill of Students Rights.

(<https://catalog.purdue.edu/content.php?catoid=7&navoid=2852#purdue-university-bill-of-student-rights>).

Academic Integrity:

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

You are expected to abide by the Purdue University Student Code of Conduct (see http://www.purdue.edu/usp/acad_policies/student_code.shtml). Turning in work that is not your own or any other form of scholastic dishonesty will result in a grade of zero (0) on an assignment/exam and may result in a grade of F for the entire course. Should the circumstances warrant a grade of F in the course, your name will automatically be forwarded to the Office of the Dean of Students. In addition, knowingly aiding and abetting, directly or indirectly, other parties in committing dishonest acts is in itself dishonest. In such cases, all parties involved will receive a zero (0) on the assignment/exam and may result in a grade of F for the entire course. Should the latter be necessary, the names of all those involved will be forwarded to the Office of the Dean of Students.

You are also encouraged to review Purdue's Honor Pledge, which can be found at <https://www.purdue.edu/provost/teachinglearning/honor-pledge.html> . You will be signing a version of this honor pledge prior to submitting all exams and other key assignments.

Please pay special attention to the following paragraph regarding teamwork (or working collaboratively with others). During this course, you will be working in teams and as such you are expected, and will be encouraged, to help each other. This is done because it has been shown that students learn more effectively while working together. Since course grades are not curved, there is no penalty for helping someone else. However, there is, at times, confusion over when it is OK to “collaborate with a teammate (or someone in the course)” and when collaborating with someone else turns into academic dishonesty.

When an assignment specifies that it is:

- **ALL-CLASS Assignment** – you should feel comfortable talking to anyone in the course (and working side-by-side with them) about any aspect of an assignment from gaining conceptual insight to developing an appropriate model to specifying assumptions to writing out a solution. If the assignment was to develop some kind of computer tool model/solution, working side-by-side with other members of the course to gain conceptual insight, develop logic, outline syntax, and implement/debug said logic and syntax would be considered acceptable behavior. In such cases all individuals involved in the assignment should be appropriately acknowledged in the materials submitted.
- **TEAM Assignment** – you should feel comfortable talking to anyone on your team (and working side-by-side with them) about any aspect of an assignment from gaining conceptual insight to developing an appropriate model to specifying assumptions to writing out a solution. If the assignment was to develop some kind of computer tool model/solution, working side-by-side with other members of your team to gain conceptual insight, develop logic, outline syntax, and implement/debug said logic and syntax would be considered acceptable behavior. In such cases all individuals involved in the assignment should be appropriately acknowledged in the materials submitted.

- **INDIVIDUAL Assignment** – you should feel comfortable talking to anyone in the course about an assignment to gain conceptual insight only. Any act other than having a “conceptual conversation,” even if mutually agreed upon, would be considered academic dishonesty. If the assignment was to develop some kind of computer tool model/solution, working with others to gain conceptual insight would be considered acceptable behavior. Any act other than having a “conceptual conversation” or “providing debugging insight,” even if mutually agreed upon, would be considered academic dishonesty.

Copyrighted Material and Derivative Works:

Please note that almost all documents produced by the Instructional Staff are copyrighted and thus are subject to Purdue University’s policies on the use of copyrighted materials. Please refer to Part 9 of the Purdue Student Miscellaneous Conduct regulations, which can be found at the following website:

<http://catalog.purdue.edu/content.php?catoid=8&navoid=8208#miscellaneous-conduct-regulations> .

All other works produced by the Instructional Staff are considered to be derivative works and thus subject to the policies outlined in Part 10 of the Purdue Student Miscellaneous Conduct regulations. In addition, notes taken by students in class are considered to be derivative works and subject to the same policies.

OTHER EXPECTATIONS, RULES, OR COMMENTS:

- A “Failure to Follow Instructions” policy is in place, which penalizes you for repetitive or flagrant violations of assignment instructions. After two repetitive or flagrant violations of assignment instructions, your assignment will automatically be returned with a grade of zero (0) with no chance of redress.
- Submission of course assignments is subject to the policies in the table on the following page. All submissions must be made using the mechanism indicated in the assignment or course materials; submissions made via a different mechanism can be rejected at the discretion of the course instructor. In certain circumstances a GTA or instructor can waive a given submission policy or mechanism **prior** to the submission; students are expected to contact the appropriate person immediately if they wish to request an exception to a certain policy.
- When submitting course assignments electronically, only the final submission will be graded. You should include all relevant files in the final submission. It is recommended that you confirm all electronic submissions have been successful to ensure that your work will be graded.
- Hand-written work:
 - All hand-written homework will be submitted on engineering paper.
 - All hand-written work will be submitted with your name, your team number and section number printed in the upper right-hand corner of your paper. In

addition, you must sign your work below your name. Your signature indicates *“this is my work and I have a general understanding of all the information that is being submitted.”*

When submitting a team hand-written homework, you should follow the same rules as stated above, except making sure to include the names of all the team members that participated. In the case of a team assignment, the signature of each individual below his/her name communicates *“I was an active participant in preparing this document and I have a general understanding of all the information that is being submitted.”*

Deliverable Type	Policies
Exams	<ul style="list-style-type: none"> • Penalties for late submission at instructor’s discretion. • Missed exams due to an excused absence must be made up within one week from original exam date unless otherwise indicated by instructor. • Students must contact their instructor as soon as possible after the exam to determine steps for making up an exam.
Readiness Assessment Tests (RATs)	<ul style="list-style-type: none"> • No late submissions accepted. • Missed RATs cannot be made up.
Homework Assignments Design Challenges	<ul style="list-style-type: none"> • Flat 30% penalty if submitted within 24 hours of on time. • No submissions accepted after 24 hours of on time.
Check For Understanding (CFU's)	<ul style="list-style-type: none"> • Penalties for late submission at instructor’s discretion. • Missed CFUs due to an excused absence must be made up within one week from original CFU date unless otherwise indicated by instructor. • Students must contact their instructor as soon as possible after the CFU to determine steps for making up the CFU.
Project Reports Project Presentations	<ul style="list-style-type: none"> • 5% of deliverable value for up to 15 minutes after the time due, assessed at timestamp of GTA email receipt. • After 15 minutes, flat 30% penalty for submission up to 24 hours late. • No submissions accepted after 24 hours.
Bonus Assignments Project Notebooks Project Design Spec Reviews Requests For Additional Information (RFAI)	No late submissions accepted.

Kit inventory sheets PoC specifications Other not-for-credit Project deliverables	1% OVERALL project score penalty
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- A late penalty will be assessed to a team assignment if submitted late due to failure of a team member to act responsibly, even if it was completed on time.
- Computer Tool Assignments:
 - You need to follow the Code Standard associated with the particular computer tool to receive maximum credit.
 - Computer tool assignments will always be submitted using the appropriate header that includes your name, your team number, and your section ID.
 - You will always provide an electronic signature (signature: your full name). Your electronic signature on an individual homework assignment indicates, *“this is my work and I have not collaborated with other individuals (other than the teaching team) to obtain the final materials being submitted.”* Your electronic signature on a team homework assignment indicates, *“I was an active participant in preparing the materials and I have a general understanding of all the information that is being submitted.”*
 - A late penalty will be assessed to a team assignment submitted late because a team member fails to act responsibly, even if it was completed on time.

Diversity and Inclusion Statement:

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue’s nondiscrimination policy may be found at http://www.purdue.edu/purdue/ea_eou_statement.html.

Mental Health Statement:

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and <http://www.purdue.edu/caps/> during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack. (<https://purdue.welltrack.com/>) Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students (<http://www.purdue.edu/odos>). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc., sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell (<https://www.purdue.edu/recwell/fitness-wellness/wellness/one-on-one-coaching/wellness-coaching.php>). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

Accessibility and Accommodations Statement:

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at drc@purdue.edu or by phone at 765-494-1247.

Basic Needs Security Statement:

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the [Critical Needs Fund](#) .