

**Instructors:**

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**Texts:** *You do not need to purchase a book for this course, but some students may be required to purchase safety shoes if their company requires them. All other safety equipment (eye, ear and hand protection will be provided by your company).*

**Course website: Canvas**

**Prerequisite Requirement Policy**

**Prerequisites:** IE248, IE271, IE361; Credit or enrollment in IE 341, IE413 and IE 448.

It is the policy of the IMSE Department to require all students enrolled in this course to have satisfied all of the course's prerequisite requirements. If it is discovered that a student has not met any applicable prerequisite requirements, he/she will be required to immediately drop the course. The failure to drop the course will result in a final course grade of 'F', regardless of course performance. Students who discover they have improperly enrolled in a course without meeting the applicable prerequisite requirements are strongly encouraged to meet with advising staff to promptly drop the course and make alternative scheduling arrangements or discuss if an official waiver of the prerequisite requirements may be applicable.

**Course Objectives:**

The primary objective of IE441 is to obtain practice in comprehensive engineering and communication skills, while simultaneously honing personal effectiveness skills, through the development and completion of an industrial design project supplied by a "real world" company. Engineering expectations include applying both previously learned and newly acquired knowledge and skills to identifying, formulating, and solving a complex engineering problem which results in tangible deliverables and a financial incentive for the company. Engineered solutions will consider extensive ramifications, including political, ethical, environmental, energy, health and safety, social, global, strategic and economic issues, as well as sustainability and feasibility of solutions. Project developments will be communicated formally and informally, through written and verbal means, to all levels of personnel. Personal effectiveness skills will be developed through an understanding of the concepts of professionalism, business and cultural etiquette, and other related topics.

Our department works hard to find a variety of projects from a variety of companies which span the range of applications where Industrial Engineers can make a difference. These projects may include Lean Assessment, Manufacturing, Operations Research, Logistics, Warehousing, Ergonomics, Industrial/Office/Hospital Operations, etc.

**Class Format:**

Lectures will be held on Monday from 2-3pm and some lab periods (see calendar). During the weeks of the career fair and final presentations, there may be no lectures. Lectures will address topics of current interest with respect to the projects, “real-world” topics, and other related material.

Grades will be based on reports (written and oral), milestone briefings, and some in-class assignments. Grades can and will be affected by your group members’ assessment of your efforts. Grades can and will also be affected by your Professionalism Evaluation, which is based on a +5/-50% scale.

Final projects will be evaluated by the class instructor, teaching assistant, and company (for grades) and by the company (for “places”); first and second place project teams will be identified. The first place team will receive \$150/team member and have their names engraved on the IE441 plaque, and the second place team will receive \$100/team member.

In the Spring there will likely be a competition for one or more teams to go to West Point in New York to compete with other IE capstone teams for a national capstone award. This is an elective opportunity that your team, in agreement with your company, can apply for.

Each semester there is a Capstone Poster session on the Friday of Dead Week. In addition, student teams are required to produce a 1 to 3 minute video that provides an overview of their capstone project. The Poster and Video content must be approved by your company and will be shared in an open format.

Most projects will involve several trips to the company site. The capstone fund will pay for all of this travel. You are encouraged to take ISU vehicles, and thus on the first week, you will apply to drive ISU cars. You may also take your personal cars, if necessary, and be reimbursed mileage.

Your initial trip will be during (Mon, Tue or Wed) of the 2<sup>nd</sup> week of class. This is a mandatory trip that is arranged with your team, your company and an instructor or TA who will accompany you. You may need to miss classes for this trip and the instructor will assist you with handling any problems which may occur with your other instructors.

In the middle of the semester there will be another group trip that will involve your company and your instructor or TA. This is the second (and only other) time that you may need to miss your other classes for a reason that the IE 441 instructor will assist you with. All other visits to your company should be organized around your course schedule.

Your team may be partnered with an English 314 team who will assist you in writing and editing your reports. This provides a good learning experience to those English students while also helping you reduce errors in your report. Please work with them productively.

**Office Hours:**

“Official” office hours on campus will be held during lab and as posted on the top of this syllabus, but please feel free to use the discussion board, email, text or call your instructor at any time. If not able to answer, leave a message. Any changes to office hours will be announced in class or emailed in advance.

## **IMSE Department Policies:**

**COURSE PREREQUISITE STATEMENT:** It is the policy of the College of Engineering to require all students enrolled in an engineering course to have satisfied all of the course's prerequisite requirements. If it is discovered that a student has not met any applicable prerequisite requirements, he/she will be required to immediately drop the course or meet with their academic advisor to discuss if an official waiver is applicable. Failure to drop the course if a pre-requisite is not met will result in 1) the student being administratively dropped from the course and/or; 2) a final course grade of 'F', regardless of course performance. Students who discover they have improperly enrolled in a course without meeting the applicable prerequisite requirements are strongly encouraged to meet with advising staff to promptly drop the course and make alternative scheduling arrangements or discuss if an official waiver of the pre-requisite requirements may be applicable.

**ACADEMIC HONESTY STATEMENT:** The IMSE Department has an expectation that all students will be honest in their actions and communications. Individuals suspected of committing academic dishonesty will be directed to the Dean of Students Office as per University policy. For more information regarding academic misconduct see <http://www.dso.iastate.edu/ja/academic/misconduct.html>.

**PROFESSIONALISM STATEMENT:** The IMSE Department has an expectation that all students will behave in a professional manner during all interactions with fellow students, faculty, and staff. Treating others with respect and having constructive communications are examples of being professional.

**DISABILITIES STATEMENT:** Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. All students requesting accommodations are required to meet with staff in Student Disability Resources (SDR) to establish eligibility. A Student Academic Accommodation Request (SAAR) form will be provided to eligible students. The provision of reasonable accommodations in this course will be arranged after timely delivery of the SAAR form to the instructor. Students are encouraged to deliver completed SAAR forms as early in the semester as possible. SDR, a unit in the Dean of Students Office, is located in room 1076, Student Services Building or online at [www.dso.iastate.edu/dr/](http://www.dso.iastate.edu/dr/). Contact SDR by e-mail at [disabilityresources@iastate.edu](mailto:disabilityresources@iastate.edu) or by phone at 515-294-7220 for additional information.

### **FREE EXPRESSION**

Iowa State University supports and upholds the First Amendment protection of [freedom of speech](#) and the principle of [academic freedom](#) in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

## **CLASSROOM DISRUPTION**

**At the discretion of the instructor**, disruptive conduct includes a single serious incident or persistent conduct that unreasonably interrupts, impedes, obstructs, and/or interferes with the educational process. Disruptive conduct may be physical and/or expressive in nature and may occur in person or in a virtual setting. Examples of disruptive conduct may include, but are not limited to, the following: speaking without being recognized, interrupting, or talking over others; arrival to class late or leaving early without instructor permission; the use of technology, such as cell phones, computers, or other devices, without instructor permission, particularly in uses unrelated to course content; creation of loud or distracting noises either carelessly or with intent to disrupt; eating, sleeping, or carrying out other personal activities in class that are unrelated to course content without instructor permission; non-protected malicious or harassing or bullying speech or actions directed at instructors or students, such as personal insults, *ad hominem* attacks, name-calling, other abusive or ridiculing comments, or threats; gratuitous use of cursing/expletives or other speech that is not relevant to class discussion; inappropriate physical contact or threats of inappropriate physical contact directed at instructors or students; refusal to comply with instructor's request for appropriate conduct.

## **Public Health**

If you are not feeling well, you should stay home and focus on your health. Should you miss class due to illness, it is your responsibility to work with your instructor to arrange for accommodations and to make up coursework, as consistent with the instructor's attendance policy. You may choose to wear a face mask and/or receive the COVID-19 vaccine and boosters, as well as other vaccines such as influenza, but those options are not required. Thielen Student Health Center will continue to provide COVID-19 vaccinations free-of-charge to students. The university will continue to offer free masks and COVID-19 test kits during the fall 2022 semester. Other wellbeing resources for students are available at:

<https://www.cyclonehealth.iastate.edu/wellbeing-resources/>

Public health information for the campus community continues to be available on Iowa State's public health website. All public health questions should be directed to [publichealthteam@iastate.edu](mailto:publichealthteam@iastate.edu).

## **PROPLANNER SOFTWARE**

To provide full disclosure, Dave Sly is also President and Founder of the Proplanner Industrial Engineering software firm located within the ISU Research Park. Given the nature of this course, Proplanner Software is often applicable to course projects. Proplanner software for Time studies, Line Balancing, Work Instructions, MES and Factory Layout is therefore provided to all students for use in their project free of charge should any student desire to use it. In addition, capstone clients are also to use the software free of charge within the scope of their project both during and after the project is completed. If your client is interested in purchasing any Proplanner products please instruct them to contact the company directly, as Dave Sly is unable to discuss Proplanner software purchase options to avoid a conflict of interest.

**If you don't read anything else in the syllabus, read this!**

This class is about the real world. You are, for all practical purposes, no longer students of engineering, but “real” engineers. When working with a company, you will be working with professional people who earn their paychecks doing what you will be doing for this class. Your grade will reflect how much value you add to the company, and how professional you are in doing so. **This isn't practice any more! It matters. Remember that** throughout the semester.

**Course Policies:**

1. The world is about communication and we will use it extensively in this class. Good grammar, spelling, and punctuation are expected; poor grammar, spelling, and punctuation will be penalized.
2. If you submit a written assignment for regrading, the entire work will be regraded. Any work to be regraded must be submitted within one week of receiving it back from the instructor.
3. There will be +/- grading.
4. There will be no rounding or curving.
5. You are expected to be in lab during lab hours. Attendance will be taken. It is expected that you may be at your company during lab hours, or in the lab. Please keep your TA informed if you will miss lab time because you are working at your company.
6. You are expected to attend all lecture classes. It is understood that sometimes you may have things that require you to miss class (interviews, plant trips, weddings, etc.). Please be professional and responsible and let the TA know when you will be gone ahead of time, either verbally (in person or by phone), or through email. Messages delivered by team members will not be sufficient notice. There won't be any make-ups, extensions, or special treatment for such activities. This means that due dates will not be moved. Missing IE441 lecture multiple times will result in a discussion with the instructor and will likely affect your professionalism grade.
7. Late assignments will be penalized at the rate of 10% per day. Assignments are due at the times stated.
8. Problems with computer technology (e.g. failed, destroyed, trashed, etc.) will not be accepted as excuses for late assignments. Make backups! Do not store your original files and backup files in the same place (physically or electronically).
9. Professionalism evaluations (+5/-50%) are made at the end of the semester by the TA and instructor. They include but are not limited to attendance, punctuality, attitude, communications, observation of peer interaction, initiative, professional presentation of work, class participation, etc.
10. Plagiarism, including accidentally forgetting to cite references, will result in a zero for any assignment.
- 11. To pass the course, you must receive a "C-" or better on the final project.**

## **COURSE DETAILS**

### **Project Selection:**

Your team will be able to select and rank a set of projects that you would like to work on. You will also be encouraged to justify why your team is the best one for your top 3 preferred projects. The instructor will use this information, along with your 1-page resumes to assign projects to specific student groups. This will be done by Friday of the first week of class.

### **Plant Visit**

You will be working with one of several companies in and around Iowa. Plant trips are scheduled for the 2<sup>nd</sup> week of class. Transportation will need to be arranged by your team. Everyone is expected to attend, to be prepared, and to act professionally. More details will be provided at the second class meeting. As many members of your team as possible, are recommended to register with ISU transportation services so that you can use ISU vehicles to drive to your companies.

### **Project Definition:**

Your Problem Statement paper defines what you will do (your deliverable) and how you will do it. It also establishes the expected value of your final result. In this course, we strive for a total impact of around, \$100,000 per project, because that would be the minimal amount that would justify the 900 hours (15 hours/week/student) that you are expected to invest into this project. After submitting your paper, you will present your problem statement to the class in a group presentation format whereby you will be graded according to your individual contribution to this presentation. After receiving feedback (a grade) on your written and oral Problem Statement, you are expected to make the corrections and present these materials to your company for their feedback. Then you will place a Final updated version of your Problem statement into your Binder and use it as a guide for the next phase of your project (Current State Analysis).

### **Individual Paper about Company in Global Economy:**

At the end of the 3<sup>rd</sup> week, you are to submit a 1 page, single spaced paper about the impact that your company has in the Global Economic, Environmental, Energy, Social and Political environment. This paper is graded according to two rubrics (quality of writing and depth of evaluation).

### **Weekly Team Journal on Canvas:**

Each week, via blackboard, you will be required to submit your assessment of the prior week. This assessment is confidential between yourself, the Instructor and the TA. This assessment will involve two key statements:

- 1) Comment on the group dynamics. Which students are working well in the team and which are not. What are your concerns with other student behaviors.
- 2) Comment on what you did specifically on the project. Be as specific as possible and state pages in the report, graphics, engineering designs, meetings, data collection, etc.

**Project Proposal Presentations:**

Roundtable presentations will be held around the 3<sup>rd</sup>\4<sup>th</sup> week of class. Each member of each team will present their project to other members of the class in a group presentation format. Grades will be based on a combination of instructor and TA evaluations. More details concerning format are provided on Blackboard.

**Internal Feedback Sessions:**

Two or three times each week during the semester, your group will sit down with the TA and/or instructor for internal feedback sessions. During these sessions, you will each have the opportunity to answer three questions: 1. What is working well? 2. What could generally be improved within the group? 3. What could I do to specifically improve my performance for the next major project event?

**Professionalism Evaluations:**

Every week, professionalism evaluations will be reviewed with the TA and/or instructor based on the logs that you submit on Canvas. If problems are seen, then the Instructor and/or TA will meet with prospective group members. It is important that you are honest, accurate and detailed in your evaluation of your activities, and the performance of your group members in your logs.

**Current State Report and Presentation at your company:**

Upon completion of your Current State Analysis Report, each group will make their own arrangements and travel to their company to do a report-out presentation. Your business partner will assess your thoroughness, professionalism, etc., using the rubric in the syllabus. This trip is arranged such that your instructor, or at least your TA, can join you for this presentation. Your presentation grade will consist of 50% from your company and 50% from your Instructor or TA.

**Future State Reports:**

Future State Design reports are due 3-4 weeks before the end of the semester, and will be both written and oral. Guidelines for the written report are included on Canvas. The oral portion is a non-graded presentation which allow you to get feedback on your design. You will then have 3 weeks to fix any issues with your design for inclusion into your Final Report due on Monday of Dead Week and your graded Final Oral Presentation on Friday of Dead week.

**Final Reports:**

Final reports will be both written and oral. Guidelines for the written report are included on Canvas, along with the grading criteria for both reports. Essentially, your Final report is an aggregation of your prior three reports written in Past Tense since your project is now complete. In addition, you will enhance your economic value analysis and confirm with your client what elements of your design that they plan to implement. Your Oral presentation will be exclusively to your company on the morning or afternoon of the Friday of Deadweek (before or after the poster session and lunch from 11-12 and 12-1 respectively). Your company will provide all of the grade for your final presentation.



**Business Value Assessment (% to implement and \$ value):**

At the end of the semester, projects will be assessed for business value and these factors will be used for the capstone semester award only (not your grade). The final project grade will include an “economic business value” and a “percent of project to be implemented” from the business partner (see Value Evaluation form on Blackboard). These statements are two of the five components to the Awards that will be presented during the Final Exam period.

**Project Costs:**

You will need to keep track of your costs beginning immediately. These numbers will be reported on throughout the semester. Costing information is detailed in this syllabus. Travel costs and material costs which are pre-approved will be reimbursed. Please work with your instructor if your team needs to purchase any items from the capstone fund. Your team is not expected to purchase any materials (except safety shoes if required) for this course.

**Design Project Schedule and Grading:**

<b><u>Design Project Tasks</u></b>	<b><u>Due Date</u></b>
Projects Assigned	Aug 23rd
Schedule Visit	Aug 24th
Plant trip (All Day)	August 28 <sup>th</sup> or 29th
<b><u>Problem Statement</u></b>	
Prob. Written Report	Sept 8th
Prob. Presentation (to class)	Sept 11 <sup>th</sup> and 13th
Individual grading	
You also present to your company that week	
Individual Global Paper	Sept 15th
<b><u>Current State Analysis (CSA)</u></b>	
CSA Report (outline)	Sept 20th
CSA Report (draft 2)	Sept 27th – also informal face-to-face meeting with client
CSA Written Report	October 4th
CSA Presentation	October 4th (week of)
At Company Site or web meeting (scheduling starts September)	
-Graded 50% company and 50% Instructor/TA	
<b><u>Future State Design (FSD)</u></b>	
Design (outline)	Oct 18th
Design (draft 2)	Oct 25th– also informal face-to-face meeting with client
FSD Written Report	Nov 1st
FSD Presentation	Start Nov 1st (week of)
Individual (ABET)	Nov 17th
<b><u>Final Project</u></b>	
Thanksgiving Break	Nov 20-24
Final Written Report	Dec 1st
Poster	Dec 4th
Video	Dec 6th
Final Presentation	Dec 15th
Graded Graded 100% company	

Graded Assignments (and percent of final grade)

- (8%) Written Project Definition Proposal + Binder
- (3%) Individual Paper on your Company in Global Environment
- (4%) Oral Project Presentation to Class (individual grading)
- (15%) Current State Analysis Report + Binder
- (10%) CSA Oral Presentation to Company
- (15%) Future State Design Report + Binder
- (5%) Individual ABET FSD Paper (POSSIBLE, if not then this adds to Final Project Report)
- (15%) Final Project Report + Binder
- (10%) Final Project Oral Presentation
- (5%) Video
- (5%) Poster
- (5%) Attendance throughout semester (Logs, Labs and Lecture)
- Factored grade according to group member feedback
- Company Value Statement (Percent to Implement and Economic Value) used in selection of winning teams ONLY – not used for semester grade.

**Canvas Default Grading Scheme**

Name	Range	
A	100%	to 93%
A-	< 93%	to 90%
B+	< 90%	to 87%
B	< 87%	to 83%
B-	< 83%	to 80%
C+	< 80%	to 77%
C	< 77%	to 73%
C-	< 73%	to 70%
D+	< 70%	to 67%
D	< 67%	to 63%
D-	< 63%	to 60%
F	< 60%	to 0%

## **How Does IE441 fit into the “big picture” of an IMSE student’s academic career?**

### **Contribution of Course to Meeting Professional Component of Curriculum:**

Students learn how to approach real-world, open-ended industrial design problems from problem definition to design recommendations. They learn to be aware of and consider real-world constraints while generating their recommendations.

### **Relationship of Course to IE Program Outcomes:**

Many of the IE Program Outcomes are addressed through the projects, material, and structure requirements of IE441. They include the following:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

**IE441**

**Design Journals (Binders)**

IE 441 journals can be thought of as a central point for all project information in a format loosely based upon the concept of design journals. Since we are not designing a project, it's not likely that our journals will become evidence in a liability or patent court case. Therefore, our journals do not have to meet some of the stricter requirements of “design journals” and can be tailored to the needs of our group project design scenario. Some suggested guidelines include the following:

- **3-ring binders** - allow materials to be inserted/organized easily
  - tabbed sections
  - page numbering not required
- **Sections (examples)**
  - Contact summary (who, when, what, where detailed notes can be found)
  - Group meeting minutes/agendas - progress/findings/updates
  - Proposal
    - Original proposal
    - Schedule
    - Updates to project (objectives, statement of work, schedule)
  - Project specific sections (one for each major area)
  - Literature review (references – state source as written book, or on-line website). Finally, indicate which group member used that resource, and where in your paper this reference was summarized.
  - Summary of articles on any subject
  - Data/analyses/drawings
  - Vendors/products
  - Brochures/cost information/comparisons/economic analyses

**Important Points**

- Organization
- Documentation
- Contacts, findings, progress, procedures
- Printed summaries (articles, procedures, findings, etc.) (anything that may go into written report or appendices)
- Do 'write-ups' in format suitable for final written report
- Track your group’s progress...and work to accomplish goals

*\*Documentation shows evidence of work (progress) and often provides written sections that fit neatly (with only minor modifications) into the final report.*

**TIP: Particular attention will be paid to meeting minutes—are tasks being assigned to group members and being completed each week? The minutes should record this information.**

**Instructor will start each review session by going over the binder.**