**Introduction to Industrial and Systems Engineering (2 Units)**

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| **Instructor:** | Shinyi Wu, PhD, Associate Professor  E-mail: [shinyiwu@usc.edu](mailto:shinyiwu@usc.edu); Office phone: 213-740-0296; Cellphone: 310-739-6873 |
| **Instructor Office Hours:** | Thursday 11 AM – 12 PM and 1 – 2 PM & by appointment  Location: [Montgomery Ross Fisher Building (MRF)](https://web-app.usc.edu/maps/) Rm 319 (in the northeast side of UPC) |
| **TA:** | Maximilian Zellner,  E-mail: mzellner@usc.edu |
| **TA Office Hours:** | Tuesday 1:15 – 2:15 PM & by appointment  Location: OHE340 |
| **Class time/place:** | Friday 10:00-11:50 AM, Room KAP 146 |

**Project and Final Reflection Schedule:**

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| Project presentation | Friday, November 22, 10:00 – 11:50 A.M.  TBD for a second session of presentation |
| Draft project written report | Tuesday, November 26, 11:59 P.M. |
| Final project written report | Friday, December 6, 11:59 P.M. |
| Final reflection | Friday, December 13, 11:59 P.M. |

**Grading:**

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| Weekly question asking (2 times) and responding (8 times) – additional responding time (i.e., 9th and 10th WQs) counts as extra credits for up to 2% | 20% |
| Participation (attendance, email, asking questions, contributions) | 10% |
| Homework and summary of guest lectures | 40% |
| Team project (including draft report, oral presentation, and final report) | 25% (5% for draft report, 10% for oral presentation and final written report, respectively) |
| Final reflection | 5% |

The grade for the course will only be based on the required work listed above and **cannot** be improved with additional work.

**Web Page:** We will use **University Blackboard** for homework posting, submission, grading, and discussion.

At the Blackboardsite you will find:

1. The syllabus
2. Lecture notes, assignments and due dates
3. Announcement of current interest - e.g. a cancelled class (it won’t happen!)

Your responsibility:

1. Learn how to use the Blackboard
2. Check your email on a regular basis
3. Download the lecture notes and assignments for each class
4. Review your grades to track your progress and standing in the class.

**Objectives of the course**

The major objectives of this course are to introduce the philosophy, practice, and goals of the discipline of industrial and systems engineering and show areas where it is applicable. Students will also learn about systems thinking to gain basic ability to understand and to deal with complex systems. In addition, through a combination of laboratory practices, expert guest lectures, and a plant tour, students will gain a fundamental understanding of the subject matter and techniques of industrial and systems engineering.

Specific course objectives include:

1. Understanding key concepts in ISE
2. Introduction to the current ISE tools and techniques
3. Introduction to ISE educational curriculum and research areas
4. Analyze a situation and use the appropriate ISE tool/technique to solve the issues
5. Familiarity with professional project reports, document design, and presentation
6. Tour at manufacturing or warehouse site
7. Participation in team projects
8. Engineering ethics and professionalism

**Participation:** This is intended to be an interactive class and your participation should increase as the semester progresses. Attendance at all classes is expected of everyone. Frequent absences will result in a reduction in grade. Punctuality is expected. If you are late, be sure not to disturb the class as you enter.

**Weekly Question:** It is animportant professional (and life) skill to ask a well-formed and insightful question. Most courses are about giving answers, but questions are generally much more interesting. In 10 weeks of the course we will randomly draw 8-9 students for whom to each ask a weekly question (WQ) for class discussion on Blackboard. **You must ask a question in the week that you are chosen to do so. No make-up is allowed unless prior arrangement has been made with the instructor.** Every student needs to answer at least one question in 8 of the 10 weeks that a WQ is assigned. You may choose to ask a question and answer a question in the same week.

The question needs to be posted on the Discussion Board on Blackboard no later than Monday at midnight. Other students then post your answers or comments to these questions (at least one question) on Blackboard by Wednesday midnight. The students who ask a WQ that week might be asked to summarize the discussions of their own WQ in class. We will discuss these questions in class only for clarification or further argument, not to judge rightness or wrongness of any particular viewpoints.

The questions should be related to the philosophy, practice, goals, education, research, or applications of the discipline of industrial and systems engineering or systems thinking. They could be based on course material, your experiences with the homework assignments, readings, project, or experiences in other classes or at work, or your own readings of papers or books. Include your name on the question sheet. Title the file as “WQ-[#]-[your name]”.

* Submit via email Blackboard assignment page, and
* Post to Discussion Board

Sample questions:

1. *How do you know whether you are looking at a system or just a bunch of stuff?*
2. *What ISE methods could help realize the following statement: “Work smarter, not harder.”?*

The questions will be graded on the following criteria:

PA = Related to industrial and systems engineering or systems thinking

CC = Related to course content

TP = Thought provoking

WF = Well formed

CN = Connect to work/school/literature

**Homework Assignments**: Readings, exercises, literature search, and guest lecture summaries and reactions will be included in homework assignment. Usually, the assignments are posted on the Blackboard on Wednesday one week prior to the due date on the syllabus. The submission cutoff time is 11:59 PM on the date specified on the assignment sheet, submitted through Blackboard Assignment manager. The TA or I will return the graded assignments one week later or at earliest possible time on the Blackboard. Late homework **cannot** be accepted, unless **prior** arrangements have been made (e.g. out of town funeral). Homework is to be **in electronic form** in 8 1/2 x 11, portrait orientation. Your name or team number should be on the first page. Team assignments should have all team members’ names on them, but only if they worked on it.

The assignments should be as professional in appearance as if you were preparing reports at work or for publication. Clearly label the assignment number, the date and your conclusions for each question, followed by the supporting calculations if applicable.

Homework will be specified either as individual or team. It’s OK to work on individual homework together, but finish it by yourself and indicate whom you worked with on top of the first page. Each student must turn in a separate homework, unless it is a team assignment. Generated data and essay questions must be unique to each student. Submit only one document per assignment (no zip files!) to the assignment manager on Blackboard. The assignment manager assigns a file name. Do not give your files to others, use others’ files, or copy answers.

Please do the following when submitting your homework to Blackboard:

* Title the file with your homework as “**HW-[#]-[your name]-[**optional, anything you want to include]”
* **Include your name** **on the first sheet of the homework** (having it in the header on all pages is even better).

**Team Project:** There will be one team project in this course to demonstrate your understanding of the discipline of ISE or about systems thinking. Each project team should be 4 to 5 students. The project instruction will be provided in class. There are many benefits to working in a team: you can debate ideas and recommendations; you can share the burden of work; you can learn from each other’s strengths; and you can verify the value of materials you learn from the course. Teams for the project must be finalized and all group members be identified on Homework #2.

**Final Reflection:** Reflection helps us grasp the precious learning experiences at university not as isolated, unrelated events, but instead to build a habit to link knowledge and to construct meaning and insight from these experiences for life. Hence, during the final period, there will be a written final reflection that asks you to reflect, synthesize, and evaluate the materials, activities, and your learning experiences in this course. You will also be asked to reflect on what we've learned in the course could be (or not) applied to contexts of your life aspiration and/or career interests.

**NEATNESS, SPELLING, AND GRAMMAR COUNT. THEY ARE AN EXPRESSION OF YOUR COMMITMENT TO DO A GOOD JOB.**

**ALWAYS BE SURE TO GIVE THE SOURCE OF ALL YOUR INFORMATION. ANYTHING TAKEN VERBATIM FROM SOMEONE ELSE MUST BE IN QUOTATION MARKS AND REFERENCED. THIS INCLUDES PARTIAL SENTENCES.**

**The required course materials consists of the following:**

1. **“Thinking in Systems”** by Meadow, D.H., Chelsea Green Publishing, 2008, ISBN-13: 978-1603580557
2. **“The Fifth Discipline”** by Senge, P.M., Doubleday Publishing, 2006, ISBN: 978-0385517256

**References:**

1. **“Lean Thinking”,** Womack, J. P., Free Press, 2003, ISBN: 0743249275
2. **“Handbook of Industrial and Systems Engineering”**, edited by Badiru, A.B., 2nd Ed., CRC Press, 2013, ISBN-13: 978-1466515048
3. **“Handbook of Industrial Engineering”**, edited by Salvendy, G., 3rd Ed., Institute of Industrial Engineers, 2007, ISBN-13: 978-0470241820
4. **“Statistical Thinking: Improving Business Performance”**, edited by Hoerl, R. and Snee R., 2nd Ed., John Wiley & Sons, Inc., 2012, ISBN-13: 978-1118094778

**Other interesting reading:**

1. Industrial Engineer, published by Institute of Industrial Engineers (IIE), <http://www.iienet2.org/IndustrialEngineer/Issue.aspx>
2. Quality Progress, published by American Society for Quality (ASQ)
3. OR/MS Today, published by Institute for Operations Research and Management Sciences (INFORMS), https://www.informs.org/ORMS-Today
4. IEEE Transactions on Engineering Management

**Course grades will be based on the following scale. The instructor reserves the right to adjust the curve based on the class performance.**

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| **Numeric Grade/ Letter Grade** | |
| 93 – 100 | A |
| 90 – 92 | A- |
| 87 – 89 | B+ |
| 83 – 86 | B |
| 80 – 82 | B- |
| 77 – 79 | C+ |
| 73 – 76 | C |
| 70 – 72 | C- |
| 67 – 69 | D+ |
| 63 – 66 | D |
| 60 – 62 | D- |
| < 60 | Failing Grade |

**Grades of A or A-** are reserved for student work which not only demonstrates very good mastery of content but which also shows that the student has undertaken a complex task, has applied critical thinking skills to the assignment, and/or has demonstrated creativity in her or his approach to the assignment. The difference between these two grades would be determined by the degree to which these skills have been demonstrated by the student.

**A grade of B+** **or B** will be given to work which is judged to be very good. This grade denotes that a student has demonstrated a more-than-competent understanding of the material being evaluated in the assignment.

**A grade of B- or C+** will be given to student work which meets that basic requirements of the assignment. It denotes that the student has done adequate work on the assignment and meets basic course expectations.

**A grade of C or C-** will denote that a student’s performance was less than adequate on an assignment, reflecting only moderate grasp of content and/or expectations.

**A grade below D+, D, or D-** would reflect a minimal grasp of the assignment, poor organization of ideas and/or several significant areas requiring improvement.

**Course Outline (tentative, subject to change)**:

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| **Session** | **Date** | **Material and Activities** | **WQ due** | **Homework due** |
| 01 | 08/30 | 1. Class Organization  2. General Introduction to Industrial and Systems Engineering  3. IISE Code of Ethics  Readings:  1. Handbook of Industrial and Systems Engineering, Chapter 1  2. NSPE Code of Ethics for Engineers,  3. ABET Engineering Code of Ethics,  <http://www.iienet2.org/details.aspx?id=299>  4. Introduction to Operations Research |  |  |
| 02 | 09/06 | 1. Industrial and Systems Engineering in Organizations 2. ISE Education and Post-Graduate Placement   Guest speakers: Prof. Kurt Palmer, PhD, and Jessica de la Cruz-Gonzalez  Readings:   1. Handbook of Industrial and Systems Engineering, Chapter 8 2. Introduction to Industrial and Systems Engineering, Chapters 1 and 2 (from Handbook of Industrial Engineering) 3. The Industrial Engineering Body of Knowledge (Skim) | WQ1 |  |
| 03 | 09/13 | 1. Understanding and Mapping Processes  2. Class Project Overview (You are encouraged to make a group meeting appointment with Prof. Wu.).  Reading:  1. Process Mapping (Chapter 2, Madison)  2. Statistical Thinking (Chapter 3 Understanding Business Processes, Hoerl & Snee) | WQ2 | HW1 |
| 04 | 09/20 | Inauguration Ceremony of President Carol L. Folt, NO CLASS.  Readings:  1. Driving Change: The UPS Approach to Business, Chapters 1-3  2. The Company of Strangers: A Natural History of Economic Life, Chapters 1 to 3 | WQ3 |  |
| 05 | 09/27 | Tour of United Parcel Service (UPS) facility in downtown LA  10:00 AM departure in front of GER  1:00 PM return to GER  Lunch will be provided.  (Wear comfortable clothing and closed toe shoes.)  Readings:  1. Statistical Thinking (Chapter 5 Process Improvement and Problem-Solving Tools, Hoerl & Snee)  2. Paper: Mellor, S; Hao, L; Zhang, D. (2016) Additive manufacturing: A framework for implementation. International Journal of Production Economics | WQ4 |  |
| 06 | 10/04 | 1. Hearing from ISE Professors: Prof. Yong Chen, PhD, about additive manufacturing and 3D printing (10 AM) 2. Process Improvement and Problem-Solving   Readings:  1. An Introduction to Human Factors Engineering  2. Introduction to Industrial and Systems Engineering, Chapters 13 and 14 | WQ5 | HW2 & project topic and team member list due |
| 07 | 10/11 | 1. Human Factors Engineering and Work Measurement  2. Meet ISE Department Chair, Prof. Maged Dessouky, PhD (11:20 AM)  Readings:  1. Thinking in Systems: Intro and Chapter 1  2. The Fifth Discipline: Chapters 4 and 5 | WQ6 |  |
| 08 | 10/18 | Fall Break, NO CLASS.  Readings:  1. Thinking in Systems: Chapters 2  2. The Fifth Discipline: Chapter 6 | No WQ | HW3 |
| 09 | 10/25 | 1. Thinking in systems: System Structures and Behaviors  2. Tour of Amazon Fulfillment Center in San Bernardino  11:00 AM departure in front of GER  3:00 PM return to GER  Lunch will be provided.  (Wear comfortable clothing and closed toe shoes.)  Reading:  1. Thinking in Systems: Chapters 3 and 4  2. The Fifth Discipline: Chapter 3  3. Paper: The global tuberculosis epidemic and progress in care, prevention, and research: an overview in year 3 of the End TB era | WQ7 |  |
| 10 | 11/01 | 1. Thinking in systems: System Surprises and Traps  2. Hearing from ISE Professors: Prof. Sze-Chuan Suen, PhD (11 AM)  Reading:  1. Thinking in Systems: Chapters 5, 6  2. The Fifth Discipline: Chapters 7 and 16  3. Navigate Port of Los Angeles website to get acquainted with its operations in preparation of the field trip:  <https://www.portoflosangeles.org/> | WQ8 |  |
| 11 | 11/08 | 1. Thinking in systems: System Changes 2. Guest Lecture by Professor Eric Shen about Port of Los Angeles 3. Port of Los Angeles field trip   11:30 AM departure in front of GER  2:30 PM return to GER  Lunch will be provided.  (Wear comfortable clothing and closed toe shoes. This is a boat tour.)  Reading:  1. Thinking in Systems: Chapter 7 | WQ9 | HW4 |
| 12 | 11/15 | 1. Lab (I) – Analysis with Excel Spreadsheet Workshop | WQ10 |  |
| 13 | 11/22 | Project Presentation I – Regular class time  Project Presentation II – Need to find an additional session | Draft project written report due on 11/26 | |
| 14 | 11/29 | Thanksgiving, NO CLASS |  | |
| 15 | 12/06 | 1. Lab (II) – Introduction to Insight Maker, literature search and reference manager with Mendeley  <https://www.mendeley.com/>  2. Hearing from ISE Professors: Prof. John Carlsson, PhD (11 AM) | Final project written report due on 12/06  Final reflection due on 12/13 | |

**ABET Student Outcomes (skills and knowledge at time of graduation)**

ABET specifies the following outcomes for Industrial Engineering programs:

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. an ability to function on multi-disciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
12. an ability to design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and energy

**University Policies and Guidelines**

The School of Engineering and the Department of Industrial and Systems Engineering adhere to the University’s policies and procedures governing academic integrity as described in Scampus. Students are expected to be **aware** of and **observe** the academic integrity standards described in Scampus. I will **enforce** these standards -- in other words, if you cheat and get caught you will get an **F** in the class.

**Attendance Policy**

Students are expected to attend every class and to remain for the duration of the class. Failure to attend class or arriving late may impact the student’s ability to achieve course objectives which could affect their course grade. Students are expected to notify the instructor by email of any anticipated absence or reason for tardiness.

University of Southern California policy permits students to be excused from class for the observance of religious holy days. This policy also covers scheduled final examinations which conflict with students’ observance of a holy day. Students must make arrangements *in advance* to complete class work that will be missed, or to reschedule an examination, due to holy days observance.

Please refer to *Scampus* for additional information on attendance policies.

**Academic Conduct**

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>.  Other forms of academic dishonesty are equally unacceptable.  See additional information in *SCampus*and university policies on scientific misconduct, [http://policy.usc.edu/scientific-misconduct](http://policy.usc.edu/scientific-misconduct/).

**Statement on Student Support Systems**

*Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call*

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.<https://engemannshc.usc.edu/counseling/>

*National Suicide Prevention Lifeline - 1-800-273-8255*

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. [http://www.suicidepreventionlifeline.org](https://urldefense.proofpoint.com/v2/url?u=http-3A__www.suicidepreventionlifeline.org_&d=DwMFAg&c=clK7kQUTWtAVEOVIgvi0NU5BOUHhpN0H8p7CSfnc_gI&r=_36nnFETM-Q6pZ6iq9FbkRLnOqB2hAKf3hpB7emICZo&m=E2UsZJRCMqi9OEfKUeqk9Y1uY3eDgl_cjSeDni9P-3s&s=twu831aNHupJnoiSEzsXZ1lmq9yCzJvEv35V5v5dYAY&e=)

*Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

*USC Student Health Sexual Assault & Survivor Support:*

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <https://policy.usc.edu/reporting-to-title-ix-student-misconduct/>

*USC Policy Reporting to Title IX– (213) 740-5086*

Works with faculty, staff, visitors, applicants, and students around issues of protected class. [https://policy.usc.edu/reporting-to-title-ix-student-misconduct/](https://equity.usc.edu/)

*Bias Assessment Response and Support*

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response.<https://studentaffairs.usc.edu/bias-assessment-response-support/>

*Student Support & Advocacy – (213) 821-4710*

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic.<https://studentaffairs.usc.edu/ssa/>

*Diversity at USC –* [*https://diversity.usc.edu/*](https://diversity.usc.edu/)

Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, and Resources for Students.

**Statement for Students with Disabilities**

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. *Please be sure the letter is delivered to the instructor as early in the semester as possible*. DSP is open from 8:30 a.m. to 5:00 p.m., Monday through Friday.

Students from all academic centers (including the Virtual Academic Center) may contact the DSP office at 213-740-0776 or [ability@usc.edu](mailto:mability@usc.edu).

**Statement about Incompletes**

The Grade of Incomplete (IN) can be assigned only if there is work not completed because of a documented illness or some other emergency occurring ***after*** the 12th week of the semester. Students must NOT assume that the instructor will agree to the grade of IN. Removal of the grade of IN must be instituted by the student and agreed to be the instructor and reported on the official “Incomplete Completion Form.”

**Policy on Late or Make-Up Work**

Assignments are due on the day and time specified (times will be specified by your instructor). Late assignments may be accepted by the instructor for review and feedback at the instructor’s discretion, but they might not be graded. [NOTE: For ISE 105, late homework **cannot** be accepted, unless **prior** arrangements have been made (e.g. out of town funeral).]

**Policy on Changes to the Syllabus and/or Course Requirements**

It may be necessary to make some adjustments in the syllabus and/or course during the semester in order to respond to unforeseen or extenuating circumstances. Any such adjustments would be made for the express purpose of accommodating students and with input from students. Adjustments that are made will be communicated to students both verbally and in writing.

**Academic Dishonesty Sanction Guidelines**

Some lecture slides, notes, or exercises used in this course may be the property of the textbook publisher or other third parties. All other course material, including but not limited to slides developed by the instructor(s), the syllabus, assignments, course notes, course recordings (whether audio or video) and examinations or quizzes are the property of the University or of the individual instructor who developed them. Students are free to use this material for study and learning, and for discussion with others, including those who may not be in this class, unless the instructor imposes more stringent requirements. Republishing or redistributing this material, including uploading it to web sites or linking to it through services like iTunes, violates the rights of the copyright holder and is prohibited. There are civil and criminal penalties for copyright violation. Publishing or redistributing this material in a way that might give others an unfair advantage in this or future courses may subject you to penalties for academic misconduct.

**Complaints**

Please direct any concerns about the course with the instructor Dr. Shinyi Wu first, by emailing her at [shinyiwu@usc.edu](mailto:shinyiwu@usc.edu) or texting her mobile phone (310)739-6873. Any concerns unresolved with the course instructor may be directed to the student’s advisor and/or the Chair of your program.

**Tips for Maximizing Your Learning Experience in this Course**

* Be proactive! Try to anticipate issues that could present challenges and please reach out to your instructor to problem-solve before rather than after the fact.
* Be mindful of getting proper nutrition, exercise, rest and sleep!
* Complete required readings and assignments before coming to class.
* Keep up with the assigned readings and assignments. Don’t procrastinate!!
* Come to class and participate in an active, respectful and meaningful way.
* Come to class prepared to ask any questions you might have. If you don't understand something, ask questions! Ask questions in class, during office hours, and/or through email!
* Form study groups with other students in the class.
* Take advantage of office hours and extra review/discussion sessions offered by your instructor. Contact your instructor if you are concerned about or are struggling in class.
* If you believe it is necessary to receive support from a content tutor or Writing Support, please inform or involve your instructor.
* Keep an open mind and positive attitude!