University of Alabama in Huntsville
Industrial & Systems and Engineering Management Department

ISE 430/530: MANUF SYS & FACILITIES DESIGN

Spring 2024

Instructor:	Dr. Cheng Chen	**Office Hour:**	Friday by appointment
Email:	Cheng.chen@uah.edu	**Office:**	OKT N149,
Class:	TR 01:00 - 02:20 PM	**Classroom:**	BAB 121

Objectives: Throughout the semester, students will develop an understanding of modern manufacturing systems design, with an emphasis on facility location and plant layout. This includes classical systems, just-in-time systems, and principles of integrated manufacturing systems design, as well as an analysis of process flow, productivity, and available space to determine facility layout:

- Compare and explain relationship between manufacturing system design, production variety and volume, and material handling systems.
- Recognize importance of technologies associated with manufacturing systems such as numerical control machines, robotics, CAD, CAM, CIM.
- Understand role of material handling technologies in a manufacturing system: conveyors, AGVs, AS/RS, robotics, CIM
- Apply control strategies to factory automation.
- Analyze AGV systems to determine number of vehicles needed, single direction conveyor systems to determine spacing, and single station cells to determine number of workstations needed.
- Perform systematic layout planning starting with a from-to chart and ending with a nodal and block representation of a layout. Understand the implications of layout planning within a lean production system.
- Perform line balancing in both single model and mixed model production lines. Implement group technology concepts into a machine cell taking into consideration the concepts associated with lean manufacturing. Understand the difference between cell and FMS.

Textbooks: You can find the following PDF online as supplementary materials to help your understanding of the course materials (Any year or edition would be fine):

- Tompkins, J. A., White, J. A., Bozer, Y. A., & Tanchoco, J. M. A. Facilities planning. John Wiley & Sons.
- Groover, M. P. Automation, production systems, and computer-integrated manufacturing. Pearson Education India.
- Sule, D. R. Manufacturing facilities: location, planning, and design. CRC press.
- Pahl, G., Beitz, W., Feldhusen, J., & Grote, K. H. Engineering design: a systematic approach. London: Springer. (Optional)

Office Hours:

- Asking for help is not shameful or embarrassing, although it is common to feel anxious when approaching a teacher. My office is a safe space for every person. The act of entering and conversing about nothing in particular often leads to new insights. Though I typically have my door open outside of office hours, I may not be able to meet for a long period of time. However, you are always welcome to drop by.
- Please feel free to ask your questions after class, by appointment, or in the GroupMe chat provided for this purpose. If the times provided are not sufficient, you may set up a meeting time with me through an appointment. Email is the most effective method of contacting me. I will respond to your inquiry within one business day.

Prerequisites: ISE324 - WORK DESIGN and MAE378 - MATERIALS & MFG PROCESS

Grading scale: (430 students only)

- Attendance: 10%
- Homework: 30%
- One in-class test: 30%
- Final project: 30%
- Total: 100%

Grading scale: (530 students only)

- Homework: 30%
- One in-class test: 30%
- Final project/Research paper: 40%
- Total: 100%

Scores	Final Course Grades
90 - 100	A
80 - 89	B
70 - 79	C
60 - 69	D
≤ 59	F

Course Schedule:
The topics listed here are intended to provide general guidance. As the class progresses, coverage and schedule may change.

Table 1:

Date	Special	Reading	Class Topic
21-Aug		Ch. 1 (1.1 - 1.7)	Syllabus Overview
26-Aug	No lecture	Ch. 1 & 2	Finish reading Chapter 2 and problems 2.1 - 2.3
28-Aug		Ch. 1 & 2	Product, Process, and Schedule Design
02-Sep		Ch. 2 & 3	Product, Process, and Schedule Design
04-Sep		Ch. 2 & 3	Product, Process, and Schedule Design
09-Sep		Ch. 3	Flow Systems, Activity Relationships and Space Requirements
11-Sep		Ch. 3	Flow Systems, Activity Relationships and Space Requirements
16-Sep		Ch. 3	Flow Systems, Activity Relationships and Space Requirements
18-Sep		Ch. 3	Flow Systems, Activity Relationships and Space Requirements
23-Sep		Ch. 4 & 6	Personnel Requirements
25-Sep		Ch. 4 & 6	Layout Planning Models & Design Algorithms
30-Sep		Ch. 4 & 6	Layout Planning Models & Design Algorithms
02-Oct	Fall Break		No lecture
07-Oct		Ch. 6	Layout Planning Models & Design Algorithms
09-Oct	Review paper proposal due	Ch. 6	Layout Planning Models & Design Algorithms
14-Oct		Ch. 6	Layout Planning Models & Design Algorithms
16-Oct		Ch. 6	Layout Planning Models & Design Algorithms
21-Oct	Mid-term exam		
23-Oct		Ch. 5	Exam review + Material Handling
28-Oct		Ch. 5	Material Handling
30-Oct		Ch. 7	Quantitative Facilities Planning Models
04-Nov		Ch. 7	Facility Design for Warehouse Operations
06-Nov		Ch. 7 & 9 & 10	Facility Design for Warehouse Operations
11-Nov	Research paper due	Ch. 7 & 9 & 10	Facilities Location
13-Nov		Ch. 7 & 9 & 10	Facilities Location
18-Nov		Ch. 8 & 9	Manufacturing Systems
20-Nov		Ch. 8 & 9	Manufacturing Systems Informatics
25-Nov	Thanksgiving		No lecture
27-Nov	Thanksgiving		No lecture
02-Dec			Project Presentations
04-Dec			Project Presentations

Homework: There are six homework assignments in total, and the number of assignments depends on the course's progress. Each assignment contains a varying number of questions, and 4 of these will be randomly selected for grading. For graduate students (530), you will have additional problems to solve for each homework assignment and exam. If a question involves a simulation, you must attach your code along with your solutions.

Tests:

- One in-class tests will be given. Depending on the progress of the lectures, the actual exam date may change.
- No make-up tests will be given. This applies to both excused and unexcused absences. If you miss a test and have a valid excused absence, the points associated with the missed test will be shifted to the final exam. If you do not have a valid excused absence, a grade of zero (0) will be recorded for the test.
- Calculators. Standard scientific calculators are allowed for use during all quizzes. Programmable calculators and wireless devices(e.g., cell phone, iPod/Pad, etc.) are not permitted.
- Formula sheet. You are permitted to bring an A4 formula sheet/a letter size paper to the exam, with notes on both the front and back. Throughout the semester, prepare this sheet by noting down the formulas you deem most important.

Research paper: 530 students may choose to write a review paper in a selected discipline. The paper topic must be proposed and approved by October 10th to avoid a 10-point deduction, and the completed paper is due by November 12th. The paper should follow the PRISMA flow diagram for structure. The quality of the paper will directly impact your score. The International Journal of Production Research journal template can be found in the Canvas folder.

Plant Layout: There will be a facilities layout project that will require you to be thinking of a process where you could improve the layout. It can be something from work, a case study that you read about, or a place that is familiar to you.

Academic Coaching: Academic Coaching at the UAH exists to address the holistic needs of undergraduate students that impact their academic success. (Visit https://www.uah.edu/ssc/tutoring/academic-coaching)

Presentation Help: UAH students looking for assistance with practicing presentations or public speaking can visit the Presentation Collaboratory. (Visit https://www.uah.edu/ssc/resources-for-students)

Student Success Workshops: Student Success Center (SSC) are offered to provide a comfortable environment where students can feel free to ask questions and engage with faculty, academic coaches, mentors, and peers. (Visit https://www.uah.edu/ssc)

Attendance: Attendance is required (in-person). Students who are absent without an excuse for more than 3 consecutive classes may have their overall score reduced by an additional 1% per missed class, or may be dropped from the course at the discretion of the instructor.

Communication Skills: Written communication is an important aspect of being an engineer. It is important that engineers are able to clearly explain difficult topics to individuals that may not be as knowledgeable on the subject. Each submittal will be graded in part on your communication skills. These include: spelling, grammar, punctuation, and clarity of writing, enunciation, voice projection, clarity and logical order of presentations.

Professionalism: Engineering faculty at UAH expect students to act in a professional manner at all times, develop the work ethics required for a successful engineering career and follow the Engineering Code of

Ethics. Engineering students at UAH are responsible for maintaining the highest standards of professionalism and professional practice.

Inclement Weather: Class will be held at its regularly scheduled time unless the University is shut down or we (instructor) make a personal decision to cancel class. In the event that we cancel class, we will post an e-mail/CANVAS message.

Disability Statement: The University of Alabama in Huntsville will make reasonable accommodations for students with documented disabilities. If you need support or assistance due to a disability, you may be eligible for academic accommodations. Apply here or contact Disability Support Services (256.824.1997 or Wilson Hall 128) as soon as possible to coordinate accommodations.

ABET outcome mapped to this course:
OUTCOME (1) ASSESSMENT: an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
This is achieved through a plant layout case study. This is one of three plant layout assignments and counted 30-40% of the grade. One of the versions is given below the table. Students were also given the option of coming up with a project and I had one student to take this option.

You will need to make and identify many assumptions as part of the design process. You may also need to perform several iterations of the various design process steps. Please document all assumptions and iterations. I am more interested in the process followed than in the final answer obtained. A project that would be considered "very good" will result in a grade in the lower 90%; to achieve a near 100% you must go beyond what is asked and enter into the realm known as "excellent." I will be looking for innovation and an attention to details. It will be in your best interest to keep your design to yourself (For example if several people have almost the same "good" or "very good" solution I will take this as an average grade and all will receive 70%.- 80%)

Mental Health Statement: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities.

The University of Alabama in Huntsville offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Department of Student Affairs located under the Health and Wellness or the UAH Counseling Center by calling 256.824.6203.

24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1.800.273.TALK or at suicidepreventionlifeline.org or a student who lives on-campus can reach out to the UAH PD dispatch to contact an on-call counselor by calling 256.824.6596. If you find yourself in a mental health emergency, call 6911 on-campus or 911 off-campus.

Subject to Change: Every effort is made to follow the guidelines in the syllabus; however, if needed, the syllabus will be amended. You will be notified if changes are made.