

EIN4451: Lean Production Systems
 Class Periods (Dr. Tufekci): MWF 5 (11:45 am–12:35 pm)
 Class Periods (Ms. Landrum): M2 (8:30 am-9:20 am) and W2-3 (8:30 am – 10:25 am)
 Academic Term: Fall 2020

Instructors

Dr. Tufekci, tufekci@ise.ufl.edu,

Office Hours: Monday and Friday 12:40 pm – 1:40 pm, on Zoom

Ms. Landrum, landrum@ise.ufl.edu, (352) 294-7732

Office Hours: Monday and Wednesday 12:00 pm – 1:00 pm or by appointment, on Zoom

Catalog Description

History of manufacturing. Principles, design, and analysis of lean manufacturing systems. Small lot production, setup-time reduction, continuous improvement. Principles and control of push and pull manufacturing systems. Production planning and operations scheduling (3 credits).

Course Pre-Requisites

ESI 4312 Operations Research I, STA 4321 Mathematical Statistics I.

Course Objectives

In this course, we will cover the following topics: history of manufacturing systems, design of different manufacturing systems, design and control of lean manufacturing systems, and planning and control problems encountered in manufacturing systems. At the end of the semester the students should be have a basic understanding of the design, operation and control of lean manufacturing systems and be able to use quantitative methods to model, analyze, and optimize such systems.

Professional Component (ABET)

This course contributes to the professional component criterion 4 part (b) by applying optimization models and methods to design manufacturing systems to convert raw materials and semi-finished assemblies into finished goods using manufacturing resources optimally to meet the stated customer needs in a cost effective way.

This course supports the ISE undergraduate program educational objectives of producing graduates who

- “will be successful professionals in industrial and systems engineering or other disciplines”,
- “can acquire advanced knowledge through continuing education or advanced degree programs”
- “can become active leaders in their profession and/or community”

Relation to Program Outcomes (ABET)

| Outcome | Coverage* |
|--|-----------|
| 1. Ability to identify, formulate and solve engineering problems by applying principles of engineering, science and mathematics | Medium |
| 2. 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 | Medium |
| 3. Ability to communicate effectively with a range of audiences | Low |
| 4. 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 | High |
| 5. 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. Ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | Low |
| 7. Ability to acquire and apply new knowledge as needed, using appropriate learning strategies | Medium |

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

No textbook is required.

Textbooks Recommended

Askin, R.G. and J.B. Goldberg. 2002. Design and Analysis of Lean Production Systems. John Wiley & Sons Inc. ISBN 0-471-11593-2

Lecture notes can be supplemented using following textbooks:

- Askin, R.G. and C.R. Stanridge. 1993. Modeling and Analysis of Manufacturing Systems. John Wiley & Sons Inc. ISBN 0-471-51418-7
- Nicholas, J. 1998. Competitive Manufacturing Management. Irwin/McGraw Hill. ISBN 0-256-21727-0
- Nahmias, S. 2004. Production and Operations Analysis. McGraw Hill/Irwin. ISBN 0-07-241741-2

Course Schedule

The instructors reserve the right to change the topics covered as they see fit.

| Session | Topic | Lecture notes |
|----------|---|---------------|
| 1 | Course introduction | - |
| 1,2 | World Class Manufacturing | 1 |
| 3 | Order Winners and Qualifiers | 2 |
| 4 | Agile Manufacturing | 3 |
| 5,6,7 | Lean Manufacturing - 5S Principles | 4 |
| 8 | TPM | 5 |
| 9 | Setup Operations | 6 |
| 10 | Pull System | 7 |
| 11 | Takt Time | 8 |
| 12 | The Philosophy of Opt | 9 |
| 13 | Value Stream Mapping | 10 |
| 14 | Factory Physics Laws and Bottleneck Scheduling | 11 |
| 15 | Review | |
| 16,17 | Kanban Card Calculations | 12 |
| 18 | Lot Streaming | 13 |
| 19 | Heijunka Scheduling | 14 |
| 20 | Heijunka Scheduling - Miltenburgs Heuristic | 15 |
| 21 | Scheduling | 16 |
| 22,23,24 | Job-shop scheduling | 17 |
| 25,26 | Project Management | 18 |
| 27 | Project Time-Cost Tradeoff | 19 |
| 28,29 | Project Scheduling (Activity on Node Job Shop) | 20 |
| 30 | Review | |
| 31 | Assembly Line Balanceing | 21 |
| 32,33 | Materials Requirements Planning (MRP) | 22 |
| 34 | Materials Requirement Planning Heuristic Lot sizing Models | 23 |
| 35 | Materials Requirement Planning Wagner Whitin Algorithm | |
| 36,37 | Aggregate Production Planning - Linear Programming and Mixed Integer Programming Models | 25 |
| 38 | Group Technology and Cellular Manufacturing | 26 |
| 39 | Quality Through Design and Taguchi's Loss | 27 |
| 40,41 | Lean 6 Sigma | 28 |
| 42 | General Review | |

Video Considerations

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy and Class Expectations

University of Florida's attendance policy will be followed in this class.

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

- Students will be assigned several homework assignments (some of which may require simple spreadsheet implementations). Homework will be assigned at least a week in advance and will be due through Canvas. No late homework assignments will be accepted, and you will get a credit of zero in case you do not submit the homework on time. Homework solutions will be posted after the submission deadline.
- The mid-term exams will be given in the evenings, and the final exam during the evening. If you have a conflict with one of the exam times, inform your instructor as soon as possible.
- Attendance is required and will be taken at each class. In addition, periodic unscheduled quizzes will take place at the end of class. These will be short (less than 5 minutes) quizzes on the material that was covered in class.
- You are responsible for all announcements made in class.
- The instructor will prepare lecture notes to accompany class discussions, which will be made available to the students through the class web site also.
- Requests for re-grading of assignments and exams will be considered only with a written explanation and only within a one-week period from the time graded work is returned in class.
- Grades will be posted on the web. Throughout the semester, you have to ensure that they are entered correctly. Corrections will be considered only within a one-week period after the grades have been posted on the web.

Make-Up Policy

If you missed an exam due to a health problem, you will need to provide documentation that indicates the date of the visit. In case of an exam conflict, you will need to present evidence of the conflict to the instructor. Please do not ask for a make-up exam to attend a job interview.

Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Grading Policy

| Assignment | Percentage of Final Grade |
|--------------|---------------------------|
| Homework | 20% |
| Midterm Exam | 25% |
| Midterm Exam | 25% |
| Final Exam | 30% |
| Total | 100% |

| Grade | Range | Grade Point |
|-------|----------|-------------|
| A | [92-100] | 4 |
| A- | [90-92] | 3.67 |
| B+ | [88-90] | 3.33 |
| B | [83-88] | 3 |
| B- | [80-83] | 2.67 |
| C+ | [78-80] | 2.33 |
| C | [73-78] | 2 |
| C- | [70-73] | 1.67 |
| D+ | [68-70] | 1.33 |
| D | [63-68] | 1 |
| D- | [60-63] | 0.67 |

Please note that this is a required course for ISE students. This means that you must earn, at a minimum, a C in order to satisfy the requirement.

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim

Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.
<https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.