AMES 5451 Optimization-based Production Management

Course description: This course is aimed at introducing models and methods for production management in modern manufacturing systems. Topics include manufacturing in America and lessons from history; basic factory dynamics; production planning and scheduling; Just-In-Time and lean operations; manufacturing resource planning; capacity management; aggregate planning; supply chain management; project management; energy modeling in manufacturing; Industry 4.0 and its impacts. The unique feature is that most topics will be presented within an unifying optimization framework, and solved by using methods such as linear programming, branch-and-cut, and our latest decomposition and coordination approach plus formulation tightening.

Credits: 3

Pre-requisites: Graduate standing

Course objective: Production management is critical to meet on-time product delivery, reduce manufacturing costs, and improve energy efficiency. Modeling and computation difficulties, however, are well recognized because of complicated manufacturing requirements and procedures, presence of discrete decision variables, and complex energy modeling of manufacturing processes. With the advancements in mixed-integer optimization, this course is designed to provide a thorough understanding of the physics, mathematical modeling and optimization methods for effective production management, and to implement and test these models and methods in software. Focuses will be on methods that can efficiently solve practical problems for near-optimal solutions with quantifiable quality.

Required textbook: To be finalized

Key references:

- *Energy Efficient Manufacturing: Theory and Applications*, John W. Sutherland, David A. Dornfeld, Barbara S. Linke, Wiley, 2018.
- *Factory Physics*, Wallace J. Hopp and Mark L. Spearman, Third Edition, Waveland Press, Inc., June 2011, ISBN-13: 9781577667391, ISBN-10: 15776673957.
- *Nonlinear Programming*, Dimitri P. Bertsekas, Third Edition, Athena Scientific, Belmont, MA, 2016.
- *IBM ILOG CPLEX Optimization Studio User's Manual*, *Version 12.6*, IBM, https://www.ibm.com/support/knowledgecenter/SSSA5P_12.6.2/ilog.odms.studio.help/pdf/usrcplex.pdf.

Computer software: Optimization software *IBM ILOG CPLEX Optimization Studio* will be introduced and used in homework assignments.

Homework: Weekly homework sets will be assigned and due next week. Homework can be done individually or in teams of two. Partners can be dynamic, but must be declared each time, and each person should submit his/her complete set. Homework truly done by individually without any consultation with other students or existing solutions shall so declare and will receive 10% bonus.

Exams: The course includes one open book midterm exam.

Project: The course includes a term project, and it can be done individually or in teams of two. The topic is of students' choice as long as it is related to manufacturing, and is not limited to topics covered in class. It can be related to the students' work, research, or beyond. It should not be like a homework assignment. Rather, deep analysis and research will be critical. Numerical implementation and testing are required. Term project proposals are due the fifth week of the semester, presentations are scheduled during the final exam week, and project reports are due at the same time.

Paper review: Starting the fifth week of the semester, each lecture will be divided into two parts. The first 2.5 hours will be used to present course materials, and the remaining half hour will be used for students to present reviews of recent publications as a preparation for term projects.

Academic integrity: All forms of academic misconduct are prohibited. The Undergraduate Academic Integrity policy regarding academic misconduct states, "Academic misconduct is dishonest or unethical academic behavior that includes, but is not limited, to misrepresenting mastery in an academic area (e.g., cheating), failing to properly credit information, research or ideas to their rightful originators or representing such information, research or ideas as your own (e.g., plagiarism)".

Comments and discussions are encouraged in class, after class, during office hours or by appointment.

Course Website: All course material (syllabus, supplemental materials, homework assignments, etc.) will be available at HuskyCT.

Course Grading:

Homework	25%
Classroom Participation	5%
Review Paper Presentation	5%
Mid Term	33%
Term Project	32%
Total	100%

Grade Scale							
A+	= 97 – 100%						
A	= 93 – 96.99%	**B**	= 83 – 86.99%	**C**	= 73 – 76.99%	**D**	= 63 – 66.99%
A-	= 90 – 92.99%	**B-**	= 80 – 82.99%	**C-**	= 70 – 72.99%	**D-**	= 60 – 62.99%
B+	= 87 – 89.99%	**C+**	= 77 – 79.99%	**D+**	= 67 – 69.99%	**F**	= 0 – 59.99%

Special accommodations: Please contact me during office hours or by appointment to discuss academic accommodations that may be needed during the semester due to a documented disability. The Center for Students with Disabilities (CSD) engages in an interactive process with each student and reviews requests for accommodations on an individualized, case-by-case basis. Depending on the nature and functional limitations of a student's documented disability, he/she may be eligible for academic accommodations. CSD collaborates with students and their faculty to coordinate approved accommodations and services for qualified students with disabilities. If you have a documented disability for which you wish to request academic accommodations and have not contacted the CSD, please do so as soon as possible. The CSD is located in Wilbur Cross,

Rm 204 and can be reached at 860-486-2020 or at csd@uconn.edu. Detailed information regarding the process to request accommodations is available on the CSD website at www.csd.uconn.edu.