AMES 5420 Introduction to Smart and Green Manufacturing

Instructor: Liang Zhang

Course description: This course is aimed at introducing foundational concepts and methods of smart manufacturing and green manufacturing. In the last decade, technology has advanced greatly in the areas of computing, sensing, communication, etc. Such advances have spurred new fields of research such as autonomous systems, internet-of-things, cyber-physical systems, etc., and have enabled a wide range of applications. Various government-led initiatives have been proposed to promote such research and development activities in manufacturing, such as Industry 4.0 in Europe, National Network of Manufacturing Innovation Institutes established in the U.S., and Made-in-China 2025. The course will discuss the impacts of the smart technologies and these initiatives on manufacturing. Course material include the architecture of smart manufacturing, sensing technology, internet-of-things, cloud manufacturing/manufacturing as a service, basic data analytics for diagnosis and prognosis in manufacturing. In addition, the course will also discuss fundamental issues in green manufacturing, such as the metrics, principles, and societal/business/policy impacts, as well as fundamental methods such as lifecycle assessment and sustainability assessment of manufacturing.

Credits: 3

Pre-requisites: Graduate standing

Course objective: Being smart and green has become two main topics in advanced manufacturing research and development. The goal of this course is to present the concepts, technologies, and practices of smart and green manufacturing. After completing the course, the students are expected to obtain:

- Knowledge of smart manufacturing initiatives and latest implementations/practices.
- Knowledge of industrial IoT technologies, such as MT Connect® standard, WirelessHART sensor networks, etc.
- The ability to design smart manufacturing processes with desired level of automation.
- The ability to carry out analysis of manufacturing process data.
- The ability to quantitatively evaluate sustainability of manufacturing processes.
- The ability to design sustainable manufacturing processes that meet desired sustainability requirements.

Required textbook: Class handouts and lecture notes

Other references:

- *Green Manufacturing*, David A. Dornfeld *ed.*, Springer, 2018
- *Sustainable Production Automation*, Andrea Matta, Stephan Biller, Ying Tang, Bengt Lennartson, Jingshan Li, *ed.*, Momentum Press, 2017
- *Sustainable Manufacturing: Challenges, Solutions and Implementation Perspectives*, Rainer Stark, Günther Seliger, Jérémy Bonvoisin, *ed.*, Springer, 2017

Homework: Bi-weekly homework sets will be assigned and are due in class in two weeks. Homework should be performed individually, however constructive discussions with classmates

are allowed. Late submissions are accepted but will be penalized with a reduced grade of 20% for each day. The lowest HW will be dropped from the final grade calculation.

Exams: The course includes two midterm exams. The exams are closed-book, closed-notes. A one-sided 8.5-by-11 "cheat" sheet is allowed for the in-class exam and two-sided for Final Exam. The sheets can only contain formulas, equations, theorems, and conclusions from the Textbook. Including answers and solutions to specific problems, such as textbook examples, homework and exam problems, on the sheets are strictly prohibited. The sheets must be handwritten, and turned in with the exam papers. Violations of the above rules will lead to serious penalty (up to 100%) on the exam scores. The exams will be graded out of 100 points.

Project: The course includes a project to be carried out by teams of 3-4 students. The project will be graded out of 100 points and will be evaluated on each of the components involved (i.e., the results obtained, quality of the project report, and of the final presentation). Project presentations will be arranged at the last one or two sessions. Details instructions about the project will be posted in a separate document and uploaded on HuskyCT.

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)".

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

Course Grading:

Homework	30%
Exam 1	25%
Exam 2	25%
Project	20%

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.