

ME 475: Manufacturing Enterprise Systems – Automation and Product Realization

<i>Course description:</i>	Manufacturing automation and product realization; role of information technology and electronic data in manufacturing enterprise systems; product life-cycle management (PLM) and related tools and processes; sustainable and green manufacturing.
<i>Number of credits:</i>	3 (2-3)
<i>Course Coordinator:</i>	Arda Gozen
<i>Prerequisites by course:</i>	ME 310 and ME 311 or ME 312
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none">1. Systems Design2. CAD in product development process3. Basic understanding of manufacturing processes4. Basic understanding of computer programming for manufacturing processes
<i>Postrequisites:</i>	None
<i>Textbooks/other required materials:</i>	Automation, Production Systems, and Computer-Integrated Manufacturing, 3 rd Edition, Mikell P. Groover, Prentice Hall, 2008, ISBN 0-13-239321-2.
<i>Course objectives:</i>	<ol style="list-style-type: none">1. Understand the elements and benefits of manufacturing automation in product realization2. Develop basic programming knowledge of CNC machines and CNC code using integrated CAD/CAM systems3. Be familiar with fundamental concepts of industrial robotics4. Learn concepts in material handling, manufacturing systems, and manufacturing support systems5. Understand the role of information systems and information management in manufacturing enterprise systems6. Consider the concepts and processes related to PDM, ERP, PLM7. Understand issues related to sustainable and green manufacturing8. Gain hands-on experience in laboratory sessions
<i>Topics covered:</i>	<ol style="list-style-type: none">1. Manufacturing automation principles and elements in product realization; Manufacturing models of production performance and metrics2. Numerical control; Comparison with discrete process control; concepts of logic control, PLCs and sequencing3. CNC programming through CAD/CAM software4. Industrial robots and related anatomy/kinematics

5. Material handling systems and analysis of material transport systems; Manual and automated production lines; cellular manufacturing; flexible manufacturing systems; Process Planning; Material Requirements Planning (MRP)
6. Integration of information technology tools and approaches in supporting modern manufacturing enterprise systems
7. Product Life-cycle Management (PLM).; Product Data Management (PDM); Enterprise Resource Management (ERP); others topics such as SCM, CRM; Lean manufacturing principles in contemporary product realization
8. Sustainable manufacturing, Eco design, environmentally conscious manufacturing

Expected learning outcomes:

1. Understand the elements of automation in manufacturing operations and different types of automation systems.
2. Be able to use quantitative models and metrics to describe and compare production performance and manufacturing cost
3. Understand the fundamental principles of numerical control and use G-code to write CNC programs; Understand elements of discrete process control.
4. Use CAD/CAM systems to create CNC programs.
5. Understand robot anatomy, common configurations, programming, and applications
6. Be able to analyze material transport systems for material flow rates, delivery cycle times, and other aspects of system performance
7. Be able to work with various algorithms in manufacturing such as line balancing algorithms; be able to identify the characteristics of flexibility in an automated manufacturing system; perform analyses of manufacturing systems to satisfy production requirements
8. Understand the role of information systems in the product life cycle and in a manufacturing enterprise; be able to identify various common tools and approaches used in industry
9. Understand the role of electronic data in modern manufacturing and how this data is managed and secured in industry through PDM/PLM/ERP
10. Understand contemporary topics related to sustainable manufacturing and environmentally friendly products and processes.

Class schedule:

Two 50-minute lecture sessions per week, for one semester;

Laboratory schedule:

1 three-hour lab per week

Contribution to meeting the professional component:

Engineering Topics

Relationship of course to student outcomes:

Meets:

1. School of MME ME educational objectives: 1, 2, 3
2. School of MME ME program outcomes: 1, 2, 3, 4, 6, 7
3. ABET EC2019, Criterion 3 program outcomes: 1, 2, 3, 4, 6, 7

Prepared by: Amy Johnson and J.L. Ding

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POLICIES

A. Reasonable Accommodation (the nature of the particular course determines which one applies):

- **Pullman Campus.** Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center.
- **WSU Online Course.** Reasonable accommodations are available in online classes for students with a documented disability. All accommodations must be approved through your WSU Disability Services office. If you have a disability and need accommodations, we recommend you begin the process as soon as possible. For more information contact a Disability Specialist on your home campus: Pullman or WSU Online (<http://accesscenter.wsu.edu>), Spokane (<http://spokane.wsu.edu/students/current/studentaffairs/disability/>), Tri-Cities (<http://www.tricity.wsu.edu/disability>), Vancouver (<http://studentaffairs.vancouver.wsu.edu/student-resource-center/disability-services>).

B. Academic Integrity

WSU expects all students to behave in a manner consistent with its high standards of scholarship and conduct. Students are expected to uphold these standards both on and off campus and acknowledge the university's authority to take disciplinary action. The Standards of Conduct for Students can be found at <http://conduct.wsu.edu>.

C. WSU Safety

WSU is committed to maintaining a safe environment for its faculty, staff, and students. Safety is the responsibility of every member of the campus community and individuals should know the appropriate actions to take when an emergency arises. In support of our commitment to the safety of the campus community the University has developed a Campus Safety Plan, <http://safetyplan.wsu.edu>. It is highly recommended that you visit this web site as well as the University emergency management web site at <http://oem.wsu.edu> to become familiar with the information provided.