# ME 475: Manufacturing Enterprise Systems – Automation and Product Realization

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| *Course description:* | 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. |
| *Number of credits:* | 3 (2-3) |
| *Course Coordinator:* | L. Li |
| *Prerequisites by course:* | ME 310; ME 311 |
| *Prerequisites by topic:* | 1. Systems Design<br>2. CAD in product development process<br>3. Basic understanding of manufacturing processes<br>4. Basic understanding of computer programming for manufacturing processes |
| *Postrequisites:* | None |
| *Textbooks/other required materials:* | Automation, Production Systems, and Computer-Integrated Manufacturing, 3rd Edition, Mikell P. Groover, Prentice Hall, 2008, ISBN 0-13-239321-2. |
| *Course objectives:* | 1. Understand the elements and benefits of manufacturing automation in product realization<br>2. Develop basic programming knowledge of CNC machines and CNC code using integrated CAD/CAM systems<br>3. Be familiar with fundamental concepts of industrial robotics<br>4. Learn concepts in material handling, manufacturing systems, and manufacturing support systems<br>5. Understand the role of information systems and information management in manufacturing enterprise systems<br>6. Consider the concepts and processes related to PDM, ERP, PLM<br>7. Understand issues related to sustainable and green manufacturing<br>8. Gain hands-on experience in laboratory sessions |
| *Topics covered:* | 1. Manufacturing automation principles and elements in product realization; Manufacturing models of production performance and metrics<br>2. Numerical control; Comparison with discrete process control; concepts of logic control, PLCs and sequencing<br>3. CNC programming through CAD/CAM software<br>4. 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:*
3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018
(ABET EC2000)

| **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **j** | **k** |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | | | 3 | | 2 | 1 | 2 | 2 | 2 |

Student Outcomes Fall 2018 forward
(ABET EC2019)

| **1** | **2** | **3** | **4** | **5** | **6** | **7** |
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| 3 | 3 | 2 | 1 | | 2 | 2 |

*Prepared by:* Andrea Butcherite and L. Li *Date:* May 30, 2018