ME 3221 – Manufacturing Automation

**Credits and Contact Hours:** 3 Credits. Three 50 minute or two 75 minute lectures per week.

**Instructors:** Zbigniew Bzymek


**Specific Course Information:**
- **Catalog Description:** Introduction to Computer Integrated Manufacturing (CIM). Fundamentals of automated manufacturing; Computer Numerical Control (CNC); production economics and optimization of production systems.
- **Prerequisites:** Consent of instructor. Not open to students who have passed ME 5440.
- **Required, Elective or Selected Elective:** Elective

**Specific Goals:**
- **Course Outcomes:**
  After completing ME 3221 students should have familiarity with:
  1. Computer Integrated Design (CID) and Computer Integrated Manufacturing (CIM)
  2. Algorithmic Methods of Problem Solving in Engineering Design and Manufacturing
  3. Computer-Aided Design (CAD) and Computer-Aided Modeling (CAM)
  4. Concurrent Engineering
  5. Design for Machining, Assembly, Manufacturing and Production
  7. Computer Control of Manufacturing, Automated Material Handling and Storage Systems
  8. Robotics Systems
  9. Quality Engineering, Statistical Process Control and Automated Inspection
  10. Manufacturing Planning and Control Systems
  11. Just-in-Time Manufacturing, Group Technology and Cellular Manufacturing Systems
  12. Flexible Manufacturing Systems, Enterprise Integration and Future Trends

- **Relationship of Course Outcomes to Criterion 3 Student Outcomes:**
  a) an ability to apply knowledge of mathematics, science, and engineering: *Students gain an ability to apply knowledge of math, science and engineering to both product and process design.*
  b) an ability to design and conduct experiments, as well as analyze and interpret data: *not applicable*
  c) an ability to design a system, component, or process to meet desired needs:
The course emphasizes the design of products and associated manufacturing process through computer-aided design and manufacturing techniques.

d) an ability to function on multi-disciplinary teams:
Students work in two to three person teams; though not truly multi-disciplinary, students utilize the principles of group dynamics as they work through all the aspects of the designs, including considerations of cost, material specification, production plan etc.

e) an ability to identify, formulate, and solve engineering problems:
Students learn how various parameters influence the design of the product as well as the process.

f) an understanding of professional and ethical responsibility:
Students are exposed to aspects of professional responsibility during discussions of the design process and as various codes and standards are cited (e.g. ASME, International Organization for Standardization, etc.) Ethical responsibility is addressed in both the product and process design, as are issues of product and process safety and environmental considerations.

g) an ability to communicate effectively:
Written reports are required on all of the projects and additionally an oral presentation will be required on one of the projects.

h) the broad education necessary to understand the impact of engineering solutions in a global and societal context:
Students learn how quality engineering, cost considerations, design functionality, safety issues and environmental considerations affect the ultimate product design.

i) a recognition of the need for, and an ability to engage in life-long learning:
Various standards, such as ASTM (American Society for Testing Materials) are discussed relative to the product designs. Forefront technologies are discussed such as the wide application of robotics and other new manufacturing technologies within a manufacturing process.

j) a knowledge of contemporary issues:
Contemporary issues relative to manufacturing processes are discussed: these include environmental impact (e.g., waste management), power utilization and consumption, design for safety and design for end of life.

k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:
Students utilize CAD (computer-aided design) and CAM (computer-aided manufacturing) packages and manufacturing automation software tools.

Topics Covered:

- Computer-aided design (CAD) process
- Product and process design
- Robotics and computer controlled systems
- Material-handling and storage systems
- Quality engineering
- Computer-aided manufacturing
- Just-in-time manufacturing systems
- Production automation technology