

# MET-4990: INTEGRATED DIGITAL MANUFACTURING PROJECT

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## Cuyahoga Community College

**Viewing: MET-4990 : Integrated Digital Manufacturing Project**

**Board of Trustees:**

January 2024

**Academic Term:**

Fall 2024

**Subject Code**

MET - Mech Eng/Manuf Ind Eng Tech

**Course Number:**

4990

**Title:**

Integrated Digital Manufacturing Project

**Catalog Description:**

Capstone course with project for IDM (Integrated Digital Manufacturing). Designed to allow students the opportunity to demonstrate and apply capabilities and skills acquired during their previous coursework. Students will choose an approved project compatible with their interest and background. The project includes electrical and mechanical systems, computer networking, Internet-of-Things (IoT), cybersecurity, manufacturing industrial software applications, data protocols, and data analytics. Project will include research, documentation, construction and testing, and conclude with a report and presentation of results.

**Credit Hour(s):**

3

**Lecture Hour(s):**

1

**Lab Hour(s):**

6

## Requisites

**Prerequisite and Corequisite**

MET-2450 Robotics and Automation in Smart Manufacturing and EET-3100 Manufacturing Network Devices and concurrent enrollment in EET-4100 Network Security for Manufacturing.

## Outcomes

**Course Outcome(s):**

Demonstrate various skill sets used in the IDM program to design, implement, and demonstrate a project.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Present a proposal for the project that will serve as the prototype for a marketable project.
  2. Construct a virtual multi-location manufacturing environment (any manufacturing processing capable of IIoT is acceptable).
  3. Determine the manufacturing process and methods of evaluation.
  4. Use wireless or wired sensors to collect data from the process.
  5. Evaluate data for functionality of operations.
  6. Send data from one site to another by using secure systems
  7. Develop a marketing strategy for the project.
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**Course Outcome(s):**

Analyze the various steps in manufacturing, data gathering, data analytics, transfer of data to other sites, security and safety in data transfer.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Compare and classify manufacturing processes.
  2. Demonstrate ability to connect multiple machines or equipment to each other and to data collection equipment.
  3. Analyze collected data for process efficiency and accuracy.
  4. Evaluate security threats.
  5. Explain how patents and copyrights are issued and rights of the inventor.
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**Course Outcome(s):**

Analyze how a connected factory functions in a multi-location environment with respect to cybersecurity protocols.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Evaluate the multi-location security needs of project.
  2. Implement and test chosen project security protocols.
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**Course Outcome(s):**

Apply the principles of modern manufacturing with considerations for IIoT, data transfer, cybersecurity and connectivity to multi-location assets.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Explain the basic principles of manufacturing including machining, robotics, hydraulics, and welding.
  2. Utilize a data collection process from equipment used in manufacturing.
  3. Analyze collected data and provide corrective solutions.
  4. Consider security measures for data transfer.
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**Course Outcome(s):**

Utilize Industry 4.0, smart manufacturing, and networking principles.

**Essential Learning Outcome Mapping:**

Not Applicable: No Essential Learning Outcomes mapped. This course does not require application-level assignments that demonstrate mastery in any of the Essential Learning Outcomes.

**Objective(s):**

1. Appraise microcontroller, PLC, or computer as core of project.
  2. Utilize proper communication protocols.
  3. Establish electrical, computer, and network objectives for the project.
  4. Analyze computer and microcontroller elements for cybersecurity.
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**Course Outcome(s):**

Use written and oral communication skills to present the project.

**Essential Learning Outcome Mapping:**

Written Communication: Demonstrate effective written communication for an intended audience that follows genre/disciplinary conventions that reflect clarity, organization, and editing skills.

**Objective(s):**

1. Write a formal report describing the design project.
2. Prepare a professional oral presentation using presentation software.

**Methods of Evaluation:**

1. Project
2. Periodic progress reports
3. Written project report
4. Oral presentation
5. Final examination

**Course Content Outline:**

1. Project Proposal
  - a. Purpose of project
  - b. Acceptable format of project proposal
2. The Design Process
  - a. Design Process Review
  - b. The Creative Process
  - c. Patents, Copyrights, and Protection of the Creative Process
  - d. Research Guidelines with Library Search and Internet Search
3. Project Construction and Testing
  - a. Block Diagram
  - b. Detailed Description
  - c. Parts List
  - d. Construction of Project
  - e. Testing of Project
  - f. Project Finalization
4. Written Project Report
  - a. Table of Contents
  - b. System Description
  - c. Results Obtained
  - d. Conclusion
5. Oral Presentation
  - a. Use of Presentation Software
  - b. Create of Block Diagram
  - c. Demonstrate Clarity and Effectiveness of Presentation
  - d. Complete Evaluation and Ranking of Oral Presentation

**Resources**

Chaudhery Mustansar Hussain and Daniel Rossit. *Designing Smart Manufacturing Systems*. First. Cambridge, MA: Academic Press, 2023.

Scott Fogler and Steven LeBlanc. *Strategies for Creative Problem Solving*. Third. Upper Saddle River, NJ: Prentice Hall, 2014.

Robert Norton. *Machine Design: An Integrated Approach*. Sixth. Upper Saddle River, NJ: Prentice Hall, 2019.

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James Bethune. *Engineering Design and Graphics with Autodesk Inventor 2020*. First. Upper Saddle River, NJ: Prentice Hall, 2019.

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Omar Santos. *Cisco CyberOps Associate CBROPS 200-201 Official Cert Guide*. First. Indianapolis, Indiana: Cisco Press, 2020. Dec 29, 2020. <https://www.ciscopress.com/store/cisco-cyberops-associate-cbrops-200-201-official-cert-9780136807834>

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