Walker Career Center
Computer Integrated Manufacturing
DOE# 4810

Course Description and Outline

Computer Integrated Manufacturing is a course that applies principles of rapid prototyping, robotics, and automation. Students will use computer controlled prototyping equipment, such as CNC mills, laser engravers, and 3D printers to solve problems by constructing actual models of their three-dimensional designs. Students will also be introduced to the fundamentals of robotics and how this equipment is used in an automated manufacturing environment. Students evaluate their design solutions using various techniques of analysis and make appropriate modifications before producing their prototypes.

Course Outline

Teacher Information and Student Supports

Name: Jim Hanson
Email: jhanson2@warren.k12.in.us
Phone: 317-532-6165

Course Supplies
- Black or Blue Pen
- Pencil (Mechanical)
- Highlighter
- Engineering Notebook (Provided)
- Calculator

Suggested Course Supplies
- USB Mouse for Chromebook
- Colored Pencils
- Large Eraser
- Second Color Pen

Additional Supports
- Tutoring is available on Tuesdays and after school until 3pm

Journey of a Graduate Skills

Critical Thinking
- Apply sketching and annotation skills to document work.
- Construct design models or finish models to display concepts of design or theory investigated.
- Formulate unbiased research questions to collect information/data.
- Apply appropriate investigative strategies.
- Evaluate sources appropriate for academic research.
- Select resources relevant to the identified problem.
- Synthesize information collected during the research process.
- Demonstrate the proper application of annotations and reference dimensions while conforming to established drafting standards.
- Inspect drawings for industry associated geometric, dimensioning, and tolerance (GD&T) standards.
- Update model and drawing views using revision specification sheets.
- Recognize the wide array of industry-wide prototyping methods in use.
- Choose the appropriate manufacturing process for a prototype.
- Compare and implement various robotics coordinate systems, paths and work envelopes and their uses.
- Analyze and compare the various drive systems used in robotics.
- Analyze degrees freedom and axis of motion in different types of robots
- Differentiate control techniques in real and in computer simulations.
- Apply concepts of physics to an automated manufacturing environment.
- Examine different types of tool holding devices used in CNC machine tools.
- Compare and contrast shop floor programming with offline programming.

- Examine part geometry to select appropriate cutting tools and fixturing devices needed to create the part using a CNC machine.
- Verify NC part programs using simulation software before machining the part on a CNC device.
- Examine computer logic and scanning sequence in automated controls.
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Communication

- Explain the importance of documentation.
- Produce working drawings using appropriate drawing styles and techniques.
- Document project components into an engineering notebook (digital or paper).
- Communicate technical knowledge in a variety of formats.
- Document best work in a portfolio (digital or paper)
- Discuss the chronological development of automation leading to robotics.
- Describe the basic components of robot and their capabilities.
- Describe the necessity for specialty tooling applications in robotics.
- Explain the history of computer controlled machines charting the growth of numerical control (NC) and how it has been implemented into private industry.
- Explain how the application of CNC machines has impacted manufacturing.
- Explain the advantages and disadvantages of CNC machining.
- Describe the difference between reference and position points.
- Demonstrate the ability to operate the user interface with various CAM systems
- Demonstrate the ability to import and export CAD files using a CAM package.
- Describe how the individual components of a flexible manufacturing system (FMS) are interrelated.
- Justify the need for computer integrated manufacturing within an organization.
- Describe the common parts of programmable logic controllers (PLC).
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Resilience

- Demonstrate relevant safety practices when using tools and equipment as determined by task, materials, environment, and protective attire.
- Design, program, and troubleshoot robotics systems.
- Complete a preliminary planning sheet to identify necessary work holding devices, cutting tools, reference points, machining sequences and safe operation.
- Demonstrate the ability to safely set up, maintain, and operate a CNC machine center using appropriate documentation and procedures.
- Set up and edit the tool library of a CNC control program, providing offset values and tool geometry
- Recognize the benefits and problems associated with CIM technology and how they impact the manufacturing process.
- Design, program, and troubleshoot PLC systems.
- Demonstrate how individual components work together to form a complete CIM system.

Collaboration

- Utilize presentation software to create a presentation that outlines team or individual priorities for design and share with peers.

Content Knowledge

- Apply corrective action(s) to eliminate hazards. Understand the format and content of industry based Material Safety Data Sheets (MSDS).
- Identify engineering and technology occupations and the roles and responsibilities of each.
- Report job outlook, demand, and projected wages for engineering and technology careers.
- Explore job opportunities that are available in engineering and technology.
- Investigate post-secondary training opportunities and industry certifications that are available.
- Explore student professional organizations related to engineering and technology.
- Demonstrate the ability to use CAD/CAM Systems.
- Utilize computer software for 2D profiling sketching functions.
- Define sketched objects with dimensions and geometric constraints
- Identify the fundamentals of creating assembly models.
- Generate an assembly drawing, which includes views, balloons and bills of material.
- Identify the positive impact robots have on manufacturing.
- Define a robot.

- Classify different types of robots.
- Plot points using absolute, relative (incremental) and polar coordinates.
- Identify the optimum location for the Point of Reference (PRZ).
- Calculate and verify appropriate spindle speeds and feed rates specific to each cutting tool utilized in an NC part program.
- Follow a safety checklist before running an NC part program on a CNC machine.
- Perform a dry run to verify the machine setup and program operation.
- Set up a CAM package by editing the material and tool libraries, defining stock sizes, selecting the appropriate post processor, and defining the units of measure to be used.
- Define and apply the fundamental and advanced milling and turning procedures used in manufacturing processes.
- Identify the typical components and subsystems that make up an automated machining, assembly and process-type manufacturing operation
- Compare and contrast the benefits and drawbacks of the three categories of CIM systems.
- Recognize the necessary safety precautions associated with a fully automated CIM system.
- Develop machine order of operations.
- Recognize the working relationship between the CNC mill and the robot

Citizenship
- Connect knowledge of diverse cultures, including global and historical perspectives, to the manufacturing environment.
- Recognize the impact of manufacturing processes on the environment.

Grade Calculation

MSD Warren Township Scale

Grade	Percentage
A	92.5 - 100
A-	89.5 - 92.4
B+	86.5 - 89.4
B	82.5 - 86.4
B-	79.5 - 82.4
C+	76.5 - 79.4
C	72.5 - 76.4
C-	69.5 - 72.4
D+	66.5 - 69.4
D	62.5 - 66.4
D-	59.5 - 62.4
F	Below 59.5

Credits/Pathways

CORE 40 Diploma
Course fulfills two credits of the elective requirement for the Core 40 diploma.

Academic/Technical Honors Diploma
Has potential to fulfill academic/technical honors diploma. - see counselor

CTE Graduation Pathway
Principles – *Introduction to Engineering Design (IED)*
Course A – *Principles of Engineering (POE)*
Course B – *Civil Engineering and Architecture (CEA)*
Or
Course B – *Computer Integrated Manufacturing (CIM)*
Or
Course B – *Digital Electronics (DE)*
Capstone – *Engineering Design & Development (EDD)*

Grading Policies

Semester Grade
Your semester grade will be calculated in the following way:

90% Assignments and Challenges, Assessments (Tests, Quizzes, Projects)
10% Final Project/Exam

Warren Central Grading Policy
The high school grading policies will be explained here

Warren Central Homework Policy
The high school homework policies will be explained here.

Synergy Grades
Grades posted in Synergy reflect the students' academic performance in the course.

Types of Assignments and Assessments

Assignments
Assignments will include classwork, and homework. These items are opportunities for students to practice the concepts learned in class.

Labs and Challenges
Each unit will have one or more larger activities. These activities are designed to demonstrate "real world" applications of the class concepts and help students develop a deeper understanding of the learning objectives.

Assessments
Tests/projects cover Indiana State Standards.

Quizzes may be given throughout a unit. There may or may not be a quiz for each unit.