Curriculum Framework – Computer Integrated Manufacturing
Unit 2 Manufacturing Processes – Lesson 2.1 Designing for Manufacturability

Desired Results *(stage 1)*

ESTABLISHED GOALS
It is expected that students will…

- G1 – Demonstrate an ability to identify, formulate, and solve engineering problems.
- G2 – Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- G3 – Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- G4 – Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- G5 – Demonstrate an ability to use the techniques, skills, and

Transfer

TRANSFER: *Students will be able to independently use their learning to …*

- T1 – Analyze the effectiveness of product design features relative to its intended use. (NGSS Engineering Practice 4)
- T2 – Develop computational model as part of a manufacturing system. (NGSS Engineering Practice 5)
- T3 – Develop an understanding of professional end ethical responsibility. (ABET 2014-2015, criterion 3f)

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – Design is a process that is used to systematically solve problems.
- U2 – Many considerations must be made when manufacturing a quality part.
- U3 – Analyzing case studies of engineering failures is a good way for engineers to avoid future failures.
- U4 – Manufacturers have an ethical responsibility to create safe products and to provide a safe work environment.
- U5 – Manufacturers have a legal responsibility to provide safety information about their products.
- U6 – Many engineering disciplines have a code of conduct or code of ethics that their members are expected to follow.
- U7 – Material properties must be considered as part of the design process.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 – How can a product be improved?
- Q2 – How can mathematical models be applied to manufacturing?
- Q3 – How do engineers apply a code of ethics?
- Q4 – How to apply a code of ethics to your personal conduct?

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modern engineering tools necessary for engineering practice. • G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. • G7 – Demonstrate an understanding of professional and ethical responsibility. • G8 – Demonstrate an ability to function on multidisciplinary teams. • G9 – Demonstrate an ability to communicate effectively. • G10 – Gain knowledge of contemporary issues. • G11 – Recognize the need for, and develop an ability to engage in life-long learning.	Acquisition ***KNOWLEDGE:*** *Students will…* • K1 – Describe steps in a design process. U1 • K2 – Describe factors which affect a design. U2, U2, U5, U7 • K3 – Identify principles of engineering ethics. U2, U4, U5, U6 • K4 – Outline how mass properties impact manufacturing decisions. U1, U2, U7	***SKILLS:*** *Students will…* • S1 – Analyze how adequate product fulfills a function. U1, U2, U3 • S2 – Summarize how a product can be modified to fulfill of function. U1, U2, U3 • S3 – Apply the engineering code of ethics when considering a design. U2, U3, U4, U5, U6 • S4 – Model an object using a drawing. U2, U7 • S5 – Show the volume, mass, surface area of a model. U2, U7 • S6 – Create a mathematical model to describe a manufacturing function. U1 • S7 – Calculate costs and physical requirements impacted by product physical properties. U2, U7 • S8 – Explain how ethics impact engineering decisions. U4, U6

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Evidence *(stage 2)*		
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning
2.1.1.A Design Flaws	• Essential questions • Engineering notebook	• Design flaw report • Conclusion questions
2.1.2.A Mass Properties	• Essential questions • Model accuracy	• Material cost calculation • Mass calculation • Cost calculation • Volume calculation • Process description
2.1.3.A Ethics and Safety	• Essential questions • Research notes • Responses to the scenario questions	• Responses to the scenario questions • Presentation of research • Conclusion questions

Learning Plan *(stage 3)*	
Activities (A), Projects (P), and Problems(B)	Knowledge and Skills
2.1.1.A Design Flaws	K1, K2, K3, S1, S2, S3
2.1.2.A Mass Properties	K4, S2, S4, S5, S6, S7
2.1.3.A Ethics and Safety	K2, K3, S2, S3, S8

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