Curriculum Framework – Computer Integrated Manufacturing
Unit 1 Principles of Manufacturing – Lesson 1.3 Cost of Manufacturing

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.

Transfer

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

- T1 – Apply a design process to solve a problem. (NGSS Engineering Practice 6)
- T2 – Optimize a variety a factors within a complex system. (NGSS Engineering Practice 2)
- T3 – Develop a complex model to manipulate and test of a proposed process. (NGSS Engineering Practice 2)

Meaning

UNDERSTANDINGS: *Students will understand that …*

- U1 – When designing a control system, cost and safety are two key factors that must be considered.
- U2 – Many factors come into play when calculating the cost of manufacturing a product.
- U3 – Tradeoffs may be made between hiring highly skilled or experienced workers and keeping costs down.
- U4 – The less time a part takes to make, the more potential profit is available.
- U5 – Long term planning and investments may cost more up front but may provide additional savings in the future.

ESSENTIAL QUESTIONS: *Students will keep considering …*

- Q1 – How do decisions related to cost, product quality and safety interrelate?
- Q2 – How can a model be used to develop a full scale system?

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• G5 – Demonstrate an ability to use the techniques, skills, and 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 – Recognize fixed and variable costs of manufacturing a product. U1, U2, U3, U4, U5 • K2 – Identify direct and indirect costs of manufacturing a product. U1, U2, U3, U4, U5 • K3 – Recognize costs of a manufacturing system. U1, U2, U3, U4, U5	***SKILLS:*** *Students will…* • S1 – Classify typical costs of manufacturing a given product. U1, U2, U3, U4, U5 • S2 – Design a manufacturing system with consideration to time and cost to produce a product. U1, U2, U3, U4 • S3 – Construct a model of a manufacturing system. U1 • S4 – Construct a control program to operate a model factory. U1, U4 • S5 – Compare the efficiencies of multiple manufacturing systems.U1, U2, U4

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Evidence *(stage 2)*			Learning Plan *(stage 3)*	
Activities (A) Projects (P) Problems(B)	Assessment FOR Learning	Assessment OF Learning	Activities (A) Projects (P) Problems(B)	Knowledge and Skills
1.3.1.A Cost Overview	• Essential questions • Responses to questions based on the presentation	• Responses to questions based on the presentation • Conclusion questions	1.3.1.A Cost Overview	K1, K2, S1
1.3.2.P Transfer System (VEX)	• Essential questions • Engineering design process iterations • Program development documentation in engineering notebook • Project rubric	• Transfer system physical construction • Number of sensors effectively used • Program psedocode • Program code • Performance of transfer system • Cost of the transfer system • Project report • Project rubric	1.3.2.P Transfer System (VEX)	K3, S1, S2, S3, S4, S5
1.3.2.P Transfer System (FT)	• Essential questions • Transfer system design iterations • Program development documentation in engineering notebook • Project rubric	• Transfer system physical construction • Number of sensors effectively used • Program flowchart • Program code • Performance of transfer system • Project report • Project rubric • Conclusion questions	1.3.2.P Transfer System (FT)	K3, S1, S2, S3, S4, S5

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