# Curriculum Framework – Computer Integrated Manufacturing
# Unit 1 Principles of Manufacturing – Lesson 1.2 Control Systems

## 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 – Function effectively within a diverse team. (ABET 2014-2015, criterion 3d)
- T3 – Develop a complex model to manipulate and test of a proposed process. (NGSS Engineering Practice 2)

### Meaning

***UNDERSTANDINGS:*** *Students will understand that …*

- U1 – Everyday products including cars, microwaves, ovens, hair dryers, coffee pots, and washing machines all use control systems to manage their operation.
- U2 – A flowcharting and pseudocode are powerful tools used by technicians, computer programmers, engineers, and professionals in a variety of roles and responsibilities.
- U3 – During the design and development process, a flowchart or pseudocode are used to plan and depict the process flow for an entire system and all of its subsystems.
- U4 – Computer programmers use a flowchart and pseudocode to organize the flow of program control, including all inputs, outputs, and conditions that may occur.

***ESSENTIAL QUESTIONS:*** *Students will keep considering …*

- Q1 – How can mechanical, electrical and software systems be integrated to solve a problem?
- Q2 – How can a tool such as a flowchart or pseudocode be adapted to design solution to a problem?
- Q3 – How can a team be diversified to enhance a design process?
- Q4 – How does a design process optimize a solution to a problem?
- Q5 – How does the effectiveness of a presentation affect the acceptability of a solution?



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| • G5 – Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.<br>• G6 – Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.<br>• G7 – Demonstrate an understanding of professional and ethical responsibility.<br>• G8 – Demonstrate an ability to function on multidisciplinary teams.<br>• G9 – Demonstrate an ability to communicate effectively.<br>• G10 – Gain knowledge of contemporary issues.<br>• G11 – Recognize the need for, and develop an ability to engage in life-long learning. | Acquisition<br>***KNOWLEDGE:*** *Students will…*<br>• K1 – Identify open and closed loop systems. U1<br>• K2 – Describe how input and output devices are part of an open and closed loop system. U1<br>• K3 – Explain the purpose of a flowchart or pseudocode. U2, U3, U4<br>• K4 – Describe functions of a computer program. U4<br>• K5 – Identify how functions of a computer program can be applied to perform a task. U4 | ***SKILLS:*** *Students will…*<br>• S1 – Operate output devices to perform a function. U1<br>• S2 – Relate sensor input to the environment being measured. U1<br>• S3 – Create a flowchart or pseudocode to perform a task. U2, U3, U4<br>• S4 – Construct a control program to accomplish an objective such as motor reacting to the environment. U4<br>• S5 – Modify an open loop system to be a closed loop system using sensors. U4 |



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| Evidence *(stage 2)* | | | Learning Plan *(stage 3)* | |
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| Activities (A)<br>Projects (P)<br>Problems(B) | Assessment FOR Learning | Assessment OF Learning | Activities (A)<br>Projects (P)<br>Problems(B) | Knowledge and Skills |
| 1.2.1.P AGV (VEX) | • Essential questions<br>• Engineering design process iterations<br>• Program development documentation in engineering notebook<br>• Project rubric | • System physical construction<br>• Number of sensors effectively used<br>• Program psedocode<br>• Program code<br>• Performance of system to complete the objective<br>• Project report<br>• Project rubric | 1.2.1.P AGV (VEX) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |
| 1.2.2.A Input Output (VEX) | • Essential questions<br>• Responses to informal questions during teacher verifications within procedure<br>• Student responses to questions in procedure | • Accuracy of testbed construction<br>• Responses to questions in procedure<br>• Conclusion questions | 1.2.2.A Input Output (VEX) | K1, K2, S1, S2 |
| 1.2.3.A Basic Output Program (VEX) | • Essential questions<br>• Responses to informal questions<br>• Output responses<br>• Program psedocode | • Output responses<br>• Program psedocode<br>• Completed programs<br>• Conclusion questions | 1.2.3.A Basic Output Program (VEX) | K1, K2, K3, K4, K5, S1, S3, S4 |
| 1.2.4.A Basic Input Program (VEX) | • Essential questions<br>• Responses to informal questions<br>• Input and output responses | • Input and output responses<br>• Program psedocode<br>• Completed programs<br>• Conclusion questions | 1.2.4.A Basic Input Program (VEX) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |



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| | • Program psedocode | | | |
| 1.2.5.A While If Else Loop (VEX) | • Essential questions<br>• Input and output responses<br>• Program psedocode | • Input and output responses<br>• Program psedocode<br>• Completed programs<br>• Conclusion questions | 1.2.5.A While If Else Loop (VEX) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |
| 1.2.6.A Variable Function (VEX) | • Essential Questions<br>• Responses to informal questions<br>• Input and output responses<br>• Program psedocode | • Input and output responses<br>• Program psedocode<br>• Completed programs<br>• Conclusion questions | 1.2.6.A Variable Function (VEX) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |
| 1.2.7.A Open Closed Loop (VEX) | • Essential Questions<br>• Responses to informal questions<br>• Input and output responses<br>• Program psedocode | • Input and output responses<br>• Program psedocode<br>• Completed programs<br>• Conclusion questions | 1.2.7.A Open Closed Loop (VEX) | K1, K2, K3, K4, K5, S1, S2, S3, S4, S5 |
| 1.2.1.P Freight Elevator (FT) | • Essential Questions<br>• Engineering design process iterations<br>• Program development documentation in engineering notebook<br>• Project rubric | • System physical construction<br>• Number of sensors effectively used<br>• Program flowchart<br>• Program code<br>• Performance of system to complete the objective<br>• Project report<br>• Project rubric | 1.2.1.P Freight Elevator (FT) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |
| 1.2.2.A Input Output (FT) | • Essential Questions<br>• Responses to questions in procedure | • Accuracy of interface setup<br>• Student responses to questions in procedure<br>• Conclusion questions | 1.2.2.A Input Output (FT) | K1, K2, S1, S2 |



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| 1.2.3.A Flowchart (FT) | • Essential questions<br>• Flowchart iterations | • Completed flowchart<br>• Conclusion questions | 1.2.3.A Flowchart (FT) | K1, K2, K3, S3 |
| 1.2.4.A Basic Program (FT) | • Essential questions<br>• Input and output responses<br>• Responses to informal questions during teacher verifications within procedure | • Input and output responses<br>• Completed programs<br>• Conclusion questions | 1.2.4.A Basic Program (FT) | K1, K2, K3, K4, K5, S1, S3, S4 |
| 1.2.5.A Branch Function (FT) | • Essential questions<br>• Input and output responses<br>• Responses to informal questions during teacher verifications within procedure | • Input and output responses<br>• Completed programs<br>• Conclusion questions | 1.2.5.A Branch Function (FT) | K1, K2, K3, K4, K5, S1, S3, S4 |
| 1.2.6.A Variable Functions (FT) | • Essential questions<br>• Input and output responses<br>• Responses to informal questions during teacher verifications within procedure | • Input and output responses<br>• Completed programs<br>• Conclusion questions | 1.2.6.A Variable Functions (FT) | K1, K2, K3, K4, K5, S1, S3, S4 |
| 1.2.7.A Open Closed Loop (FT) | • Essential questions<br>• Input and output responses<br>• Responses to informal questions | • Input and output responses<br>• Completed programs<br>• Conclusion questions | 1.2.7.A Open Closed Loop (FT) | K1, K2, K3, K4, K5, S1, S2, S3, S4, S5 |



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| | during teacher verifications within procedure | |
| 1.2.8.A Subprogram (FT) | • Essential questions<br>• Input and output responses<br>• Responses to informal questions during teacher verifications within procedure | • Input and output responses<br>• Completed programs<br>• Conclusion questions |

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| 1.2.8.A Subprogram (FT) | K1, K2, K3, K4, K5, S1, S2, S3, S4 |



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