

| Robotics 2                            |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                    |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 1 Safety</i> |                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                    |
| <b>Level 4</b>                        | <b>The student:</b> <ul style="list-style-type: none"> <li>Evaluate new lab – robotics system installations and applications for potential safety issues – needed protective measures and practices.</li> </ul>                          | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Give student a drawing, blueprint, or computer simulation of a lab – robotics system installation and have them identify hazards, safety protocols needed, and safety measures needed.</li> </ul>  |
| <b>Level 3</b>                        | <b>The student:</b> <ul style="list-style-type: none"> <li>Explain safety hazards of their classroom lab including specific hazards and safety practices required by each student operated machinery item in their classroom.</li> </ul> | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Pass lab safety test with a 100 percent score.</li> </ul>                                                                                                                                          |
| <b>Level 2</b>                        | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify – recognize general safety hazards associated with electricity, machinery and robotic devices.</li> </ul>                                                            | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Safety demonstrations - briefings on electricity, robotics systems, and lab machinery.</li> <li>Separate briefings on safe operation of the exact equipment installed in classroom lab.</li> </ul> |
| <b>Level 1</b>                        | With help, partial success of Level 2 content.                                                                                                                                                                                           | -----                                                                                                                                                                                                                                                              |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

| Robotics 2                                                     |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                    |
|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 2 Robot Ethics and Social Impacts</i> |                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                    |
| <b>Level 4</b>                                                 | <b>The student:</b> <ul style="list-style-type: none"> <li>Use knowledge of Robotics History and projected future capabilities to theorize the social impacts of robots in 10-20-50 and 100 years.</li> </ul>                                                                                                                                                                                        | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Research paper</li> <li>Future society plan based on current idea of “work” has been changed due to robots.</li> </ul>                                             |
| <b>Level 3</b>                                                 | <b>The student:</b> <ul style="list-style-type: none"> <li>Evaluate the social benefits and negative consequences of robotics and automation.</li> <li>Describe the ethical impacts of robotic and automation.</li> <li>Identify local companies where industrial robots are used daily.</li> <li>Identify the uses of robotics in industry and how they impact manufacturing-production.</li> </ul> | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Class discussion on the ethics of armed autonomous military drones.</li> <li>Class discussion on employment impact from drones – self driving vehicles.</li> </ul> |
| <b>Level 2</b>                                                 | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify local companies where industrial robots are used daily.</li> <li>Identify the uses of robotics in industry and how they impact manufacturing-production.</li> </ul>                                                                                                                                                              | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Tour of local businesses using industrial robotics</li> <li>Internet research of local robotics employment.</li> </ul>                                             |
| <b>Level 1</b>                                                 | With help, partial success of Level 2 content.                                                                                                                                                                                                                                                                                                                                                       | -----                                                                                                                                                                                                                              |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

| Robotics 2                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 3 Robot Education and Career Pathways</i> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                  |
| <b>Level 4</b>                                                     | <b>The student:</b> <ul style="list-style-type: none"> <li>Create an educational pathway report detailing training required along with where, when, and how it is offered.</li> </ul>                                                                                                                                                                                                                                                                                                                                     | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Research paper</li> </ul>                                                                                                                                                                                                                                        |
| <b>Level 3</b>                                                     | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify the four engineering fields that impact robotics and automation.</li> <li>Explain the difference between operators, maintenance technicians, control technicians, and control engineers.</li> <li>Identify the type of occupational training that will prepare them for a career in robotics.</li> <li>Respond to the question “Will Robots Steal Our Jobs?” based on what has happened in the past and employment outlook for the future.</li> </ul> | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Watch and discuss “Will Robots Steal Our Jobs? (1-2-3)”.</li> <li>Research training required for robotics careers.</li> </ul>                                                                                                                                    |
| <b>Level 2</b>                                                     | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify the four engineering fields that impact robotics and automation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                           | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Research how mechanical, electrical, manufacturing, and computer science knowledge is required to create autonomous robots.</li> <li>Identify the sections of a robotics system utilizing skills from the four engineering fields impacting robotics.</li> </ul> |
| <b>Level 1</b>                                                     | With help, partial success of Level 2 content.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -----                                                                                                                                                                                                                                                                                                                            |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

| Robotics 2                                          |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 4 Mechanical Advantage</i> |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                          |
| <b>Level</b><br><br>4                               | <b>The student:</b> <ul style="list-style-type: none"> <li>Design and construct a competition robot calculating the documenting speed, displacement, velocity, and acceleration of the robot and key systems on it.</li> </ul>                                                                   | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Competition robot design and construction.</li> </ul>                                                                                                                                                    |
| <b>Level</b><br><br>3                               | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify the six simple machines defined by Renaissance scientists.</li> <li>Discuss the difference between distance, displacement, speed, velocity, and acceleration.</li> <li>Calculate linear and angular acceleration.</li> </ul> | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Using Vex or other robot kits build robots utilizing the six simple machines to successfully do tasks.</li> </ul>                                                                                        |
| <b>Level</b><br><br>2                               | <b>The student:</b> <ul style="list-style-type: none"> <li>Identify the six simple machines defined by Renaissance scientists.</li> </ul>                                                                                                                                                        | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Using K'nex, Lego, or similar kits have students build the six simple machines defined by Renaissance scientists.</li> <li>Have students identify these machine devices in a robotics system.</li> </ul> |
| <b>Level</b><br><br>1                               | With help, partial success of Level 2 content.                                                                                                                                                                                                                                                   | -----                                                                                                                                                                                                                                                                    |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

| Robotics 2                                        |                                                                                                                                                                                    |                                                                                                                         |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 5 Sensor Programming</i> |                                                                                                                                                                                    |                                                                                                                         |
| Level 4                                           | <ul style="list-style-type: none"> <li>Student can build a program using if - else, looping, and input-output control structures to accomplish a complex assigned task.</li> </ul> | <ul style="list-style-type: none"> <li>Write a robot program that meets industry standards</li> </ul>                   |
| Level 3                                           | <ul style="list-style-type: none"> <li>Student can use inputs and outputs to control program flow.</li> </ul>                                                                      | <ul style="list-style-type: none"> <li>Create a state machine using switch statements controlled by sensors.</li> </ul> |
| Level 2                                           | <ul style="list-style-type: none"> <li>Student can create flow charts for looping control structures.</li> </ul>                                                                   | <ul style="list-style-type: none"> <li>Monitor sensors using loops</li> </ul>                                           |
| Level 1                                           | Student can compare values using relational operators.                                                                                                                             | Write "if - else" statements for sensors.                                                                               |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

# Robotics 2 (Aug 2018) Proficiency Scales

| Robotics 2                                     |                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                    |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 6 Robot Operation</i> |                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                    |
| Level                                          | The student:                                                                                                                                                                                                                                                                                                                                                 | Activities/Tasks:                                                                                                  |
| 4                                              | <ul style="list-style-type: none"> <li>Build and program a small robot arm or 3D printing machine.</li> </ul>                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Small robot arm or 3D printer design, construction, programming.</li> </ul> |
| 3                                              | <ul style="list-style-type: none"> <li>Define the cartesian coordinate system for 2D (X-Y) and 3D (X,Y,Z,) robots.</li> <li>Define Yaw, Pitch, Roll</li> <li>Identify points in 2D (X-Y) and 3D (X-Y-Z) coordinates.</li> <li>Demonstrate one-hand (6-axis) robot control of X, Y, Z, RX, RY and, RZ axis's.</li> <li>Zero and re-zero robot arm.</li> </ul> | <ul style="list-style-type: none"> <li>Set-up and control actual or simulated 6-axis robot arm.</li> </ul>         |
| 2                                              | <ul style="list-style-type: none"> <li>Define the cartesian coordinate system for 2D (X-Y) and 3D (X,Y,Z) robots.</li> <li>Define Yaw, Pitch, Roll</li> </ul>                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>Create "G" code for CNC or 3D printing machine.</li> </ul>                  |
| 1                                              | With help, partial success of Level 2 content.                                                                                                                                                                                                                                                                                                               | -----                                                                                                              |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)

| Robotics 2                                       |                                                                                                                                                                                                                                               |                                                                                                                                                                     |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Learning Goal: Strand 7 Robot Maintenance</i> |                                                                                                                                                                                                                                               |                                                                                                                                                                     |
| <b>Level</b><br><br>4                            | <b>The student:</b> <ul style="list-style-type: none"> <li>Based on actual robot competition experience create or drastically revise a robot inspection and maintenance plan based on actual competition experience for the robot.</li> </ul> | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Creation of “new” maintenance – inspection plan for an already competed robot.</li> </ul>           |
| <b>Level</b><br><br>3                            | <b>The student:</b> <ul style="list-style-type: none"> <li>Develop a maintenance schedule plan for a robot system.</li> </ul>                                                                                                                 | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Create a maintenance- inspection pan for a VEX, FIRST, or other robot competition robot.</li> </ul> |
| <b>Level</b><br><br>2                            | <b>The student:</b> <ul style="list-style-type: none"> <li>Define preventative maintenance</li> </ul>                                                                                                                                         | <b>Activities/Tasks:</b> <ul style="list-style-type: none"> <li>Read robot manual for required preventative maintenance</li> </ul>                                  |
| <b>Level</b><br><br>1                            | With help, partial success of Level 2 content.                                                                                                                                                                                                | -----                                                                                                                                                               |

4 - In addition to exhibiting level 3 performance, in-depth inferences and applications that go beyond what was taught in class

3 - No major errors or omissions regarding any of the information and/or processes (simple or complex) that were explicitly taught

2 - No major errors or omissions regarding the simpler details and processes but major errors or omissions regarding the more complex ideas and processes

1 - With help, a partial knowledge of some of the simpler and complex details and processes.

\*Emphasized standard(s)