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# ROBOTICS TECHNICIAN



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## LEARNER GUIDE

National Vocational Certificate Level 1-4

Version 1 - October, 2019



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- **Learning Units:**
  - Learning Units are the main sections within each module
- **Learning outcomes:**
  - Learning outcomes of each learning units are taken from the curriculum document
- **Learning Elements:**
  - This is the main content of your learner's guide with detail of the knowledge and skills (practical activities, projects, assignments, practices etc.) you will require to achieve learning outcomes stated in the curriculum
  - This section will include examples, photographs and illustrations relating to each learning outcome
- **Summary of modules:**
  - This contains the summary of the modules that make up your learner's guide
- **Frequently asked questions:**
  - These have been added to provide further explanation and clarity on some of the difficult concepts and areas. This further helps you in preparing for your assessment.
- **Multiple choice questions for self-test:**
  - These are provided as an exercise at the end of your learner's guide to help you in preparing for your assessment.

## Modules

### Module: 0714001050 Perform basic machining operations

**Objective of the Module:** This competency standard is designed to gain basic knowledge and skills required to read and interpret assembly drawings, perform bench work operations using different tools and equipment, perform lathe machine operations and prepare materials for a welding job in accordance with the organization's approved guidelines and procedures.

|           |             |        |         |        |           |        |
|-----------|-------------|--------|---------|--------|-----------|--------|
| Duration: | Total hours | 50 Hrs | Theory: | 10 Hrs | Practical | 40 Hrs |
|-----------|-------------|--------|---------|--------|-----------|--------|

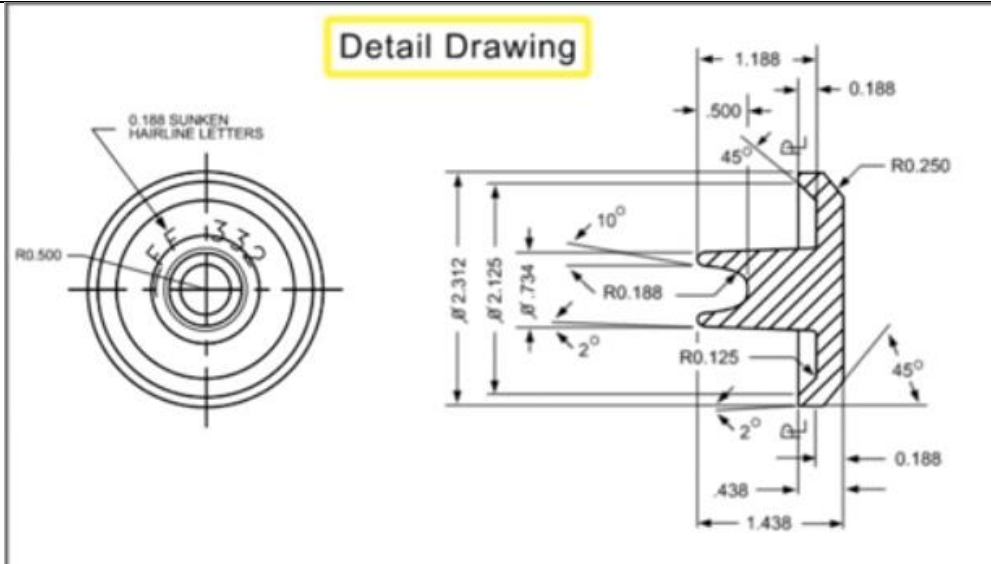
| Learning Unit                           | Learning Outcomes                                                                                                                     | Learning Elements                                                                                                                                                                                                                                                            | Materials (Tools & Equipment) Required                                              |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>LU1: Interpret Assembly Drawings</b> | The trainee must be able to: <ul style="list-style-type: none"><li>• Recognize basics of lines used in engineering drawings</li></ul> | <ul style="list-style-type: none"><li>• Demonstrate the lines on physical drawing sheets</li><li>• describe types of lines use in engineering drawings</li><li>• describe the lines thickness qualities</li><li>• demonstrate pencil types to draw the engineering</li></ul> | <ul style="list-style-type: none"><li>• Sample drawing sheets or Sketches</li></ul> |

|                                                     |                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                     | <ul style="list-style-type: none"> <li>• Understand different types of lines in engineering drawings</li> <li>• Understand types of drawing views</li> <li>• Identify assembly requirements according to drawings</li> </ul>                           | <p>drawing lines</p> <ul style="list-style-type: none"> <li>• develop the insight to see the different views of an engineering parts</li> <li>• demonstrate the engineering views on actual drawing sheets</li> <li>• demonstrate the assembly points mention in an industrial drawing</li> <li>• demonstrate the signs using in assembly drawings</li> <li>• demonstrate the assembly drawing sheet and its building on any commercial software</li> </ul> <p><b>Practicle-1</b></p> <ul style="list-style-type: none"> <li>• Draw the free hand sketches of assembly parts on sketch books</li> <li>• draw the different assembly lines on drawing sheet</li> <li>• draw the free hand sketches of drawing views</li> <li>• explain the drawing sheets using in real time industrial assembly lines</li> </ul> | <ul style="list-style-type: none"> <li>• Layout tools</li> <li>• Measuring devices (screw gauge, Vernier calliper)</li> <li>• Handheld calculator</li> <li>• Hacksaw</li> <li>• Special robot tool kit</li> <li>• P.P.E</li> <li>• Drill set</li> <li>• Drill machine</li> <li>• Grinder</li> <li>• Hacksaw</li> <li>• Drill set</li> <li>• Drill machine</li> <li>• Grinder</li> <li>• Turret lathe machine</li> <li>• Tool grinder</li> <li>• Lathe cutting tools</li> <li>• Multi- process</li> <li>• welding equipment</li> </ul> |
| <b>LU2: Perform Bench Work on Metallic Surfaces</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Carry-Out Sawing</li> <li>• File the Work-Piece</li> <li>• Carry out Drilling Process</li> <li>• Produce Threads on Work-Piece</li> <li>• Perform Hand Reaming</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the types of foils and their usage</li> <li>• describe the using of bench voices</li> <li>• Describe the threads types</li> <li>• demonstrate the types of tap die for making threads on work piece</li> <li>• Describe the drilling &amp; reaming process</li> <li>• Demonstrate the drilling &amp; reaming tools on industrial grounds</li> </ul> <p><b>Practicle-1</b></p> <ul style="list-style-type: none"> <li>• make the work piece using foils and tap dies using bench voices</li> <li>• perform the drilling operations on work piece using bench voices</li> <li>• develop the work piece/die using the reaming tools</li> </ul>                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                                            |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                  |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU3. Prepare Lathe Machine for Different Operations</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Prepare Materials for Lathe Operations</li> <li>• Select Tools and Equipment</li> <li>• Set Lathe Machine for Operations</li> </ul>                                                                                                   | <ul style="list-style-type: none"> <li>• Describe the lathe machine parts</li> <li>• Describe the lathe machine operations</li> <li>• Demonstrate the lathe machine tools used for different operations</li> </ul>                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• Base metals</li> <li>• Welding machine</li> <li>• Engine lathe machine</li> <li>• Personal safety kits</li> <li>• Hardware complete tool kit</li> </ul> |
|                                                            |                                                                                                                                                                                                                                                                                                             | <b>Practicle-1</b> <ul style="list-style-type: none"> <li>• develop the different work pieces using lathe machine operations</li> <li>• develop the machine parts used in an assembly line</li> </ul>                                                                                                                                                                                                                                           |                                                                                                                                                                                                  |
| <b>LU4. Prepare Materials for Welding</b>                  | The trainee must be able to: <ul style="list-style-type: none"> <li>• Select and Mark Material/s as per Drawing/Job Requirement</li> <li>• Cut and Prepare Edge/s of Base Materials</li> <li>• Knowledge of welding equipment</li> <li>• Fit-up Base Materials</li> <li>• Knowledge of materials</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the welding and its types</li> <li>• Demonstrate the welding processes</li> <li>• describe the welding rods and their usage conditions</li> <li>• describe the codes written on welding rods and their suitability with different welding conditions</li> <li>• demonstrate the welded joints</li> <li>• describe the needs of particular type of welding in a specified condition</li> </ul> |                                                                                                                                                                                                  |
|                                                            |                                                                                                                                                                                                                                                                                                             | <b>Practice-1</b> <ul style="list-style-type: none"> <li>• Perform the welding operations to join the real time industrial broken parts used in an assembly line/robotic</li> </ul>                                                                                                                                                                                                                                                             |                                                                                                                                                                                                  |

|  |  |                                                                                                                                                                                |  |
|--|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  | production line.                                                                                                                                                               |  |
|  |  | <b>Practice-2</b><br>Select, arrange and prepare tools and equipment for ARC welding.<br><b>Practice-3</b><br>Select, arrange and prepare tools and equipment for GAS welding. |  |

## Module 1:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            |                          |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|--------------------------|--------------------------|----------------------------------------|----------------------------------------|--|-------------|--|-----------|--|------|--|----------------------|--|-----------|--|--------|--|-----------------------|--|---------|--|--|--|------------------------|--|----------|--|--|--|-----------------|--|--------|--|--|--|----------------------|--|--|--|--|--|---------------------|--|--|--|---------|--|--------------|--|--|--|------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------|
| Videos                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Link                                                       |                          |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| <div><div>Detail Drawing</div><p>0.188 SUNKEN HAIRLINE LETTERS</p><p>R0.500</p><p>1.188</p><p>0.188</p><p>0.500</p><p>45°</p><p>R0.250</p><p>10°</p><p>R0.188</p><p>2°</p><p>R0.125</p><p>45°</p><p>0.188</p><p>0.438</p><p>1.438</p><p>2.312</p><p>2.125</p><p>0.734</p></div> <table><tr><td colspan="2">UNLESS OTHERWISE SPECIFIED<br/>ALL DIMENSIONS ARE IN INCHES</td><td colspan="2">PROJECT NO.<br/>PR - 2205</td><td colspan="2">ACME TECH INDUSTRIES CO.<br/>DOVER, VA.</td></tr><tr><td colspan="2">TOLERANCES:</td><td colspan="2">APPROVALS</td><td colspan="2">DATE</td></tr><tr><td colspan="2">1 PLACE DIMS: +/- .1</td><td colspan="2">DRAWN CBK</td><td colspan="2">5 - 26</td></tr><tr><td colspan="2">2 PLACE DIMS: +/- .03</td><td colspan="2">CHECKED</td><td colspan="2"></td></tr><tr><td colspan="2">3 PLACE DIMS: +/- .005</td><td colspan="2">APPROVED</td><td colspan="2"></td></tr><tr><td colspan="2">ANGULAR: +/- 1°</td><td colspan="2">ISSUED</td><td colspan="2"></td></tr><tr><td colspan="2">FRACTIONAL: +/- 1/32</td><td colspan="2"></td><td colspan="2"></td></tr><tr><td colspan="2">MATERIAL: CAST IRON</td><td colspan="2"></td><td colspan="2">PART: A</td></tr><tr><td colspan="2">FINISH: NONE</td><td colspan="2"></td><td colspan="2">PROCESS NO.: DRAWING NO.: FR - 332</td></tr></table> | UNLESS OTHERWISE SPECIFIED<br>ALL DIMENSIONS ARE IN INCHES |                          | PROJECT NO.<br>PR - 2205 |                                        | ACME TECH INDUSTRIES CO.<br>DOVER, VA. |  | TOLERANCES: |  | APPROVALS |  | DATE |  | 1 PLACE DIMS: +/- .1 |  | DRAWN CBK |  | 5 - 26 |  | 2 PLACE DIMS: +/- .03 |  | CHECKED |  |  |  | 3 PLACE DIMS: +/- .005 |  | APPROVED |  |  |  | ANGULAR: +/- 1° |  | ISSUED |  |  |  | FRACTIONAL: +/- 1/32 |  |  |  |  |  | MATERIAL: CAST IRON |  |  |  | PART: A |  | FINISH: NONE |  |  |  | PROCESS NO.: DRAWING NO.: FR - 332 |  | <div><div>Interpret Drawing</div><a href="https://www.youtube.com/watch?v=5E8SCm0K0_4">https://www.youtube.com/watch?v=5E8SCm0K0_4</a></div> |
| UNLESS OTHERWISE SPECIFIED<br>ALL DIMENSIONS ARE IN INCHES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                            | PROJECT NO.<br>PR - 2205 |                          | ACME TECH INDUSTRIES CO.<br>DOVER, VA. |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| TOLERANCES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                            | APPROVALS                |                          | DATE                                   |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| 1 PLACE DIMS: +/- .1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                            | DRAWN CBK                |                          | 5 - 26                                 |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| 2 PLACE DIMS: +/- .03                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                            | CHECKED                  |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| 3 PLACE DIMS: +/- .005                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                            | APPROVED                 |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| ANGULAR: +/- 1°                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                            | ISSUED                   |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| FRACTIONAL: +/- 1/32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                            |                          |                          |                                        |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| MATERIAL: CAST IRON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                            |                          |                          | PART: A                                |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |
| FINISH: NONE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                            |                          |                          | PROCESS NO.: DRAWING NO.: FR - 332     |                                        |  |             |  |           |  |      |  |                      |  |           |  |        |  |                       |  |         |  |  |  |                        |  |          |  |  |  |                 |  |        |  |  |  |                      |  |  |  |  |  |                     |  |  |  |         |  |              |  |  |  |                                    |  |                                                                                                                                              |



## Lathe Machine Operation

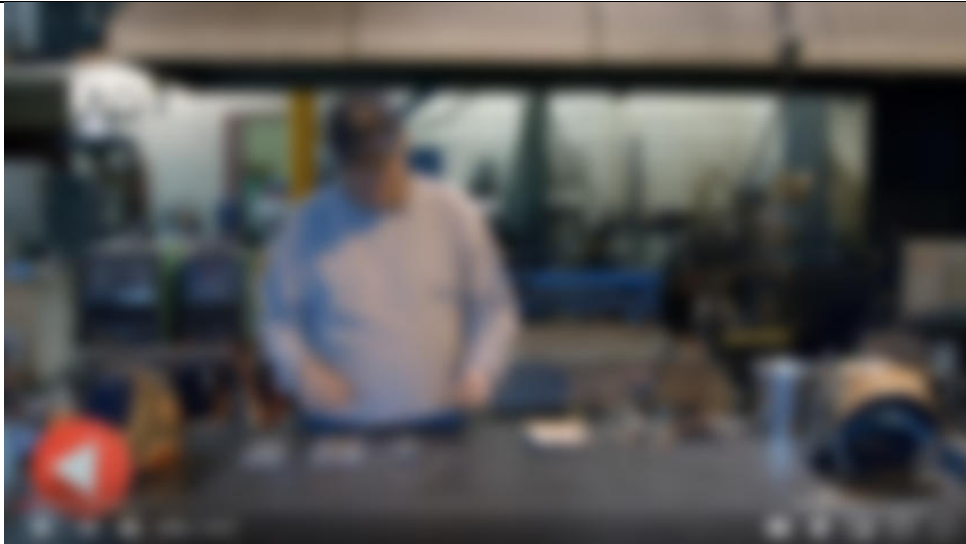
<https://www.youtube.com/watch?v=XXpOwsD0fWM>



## Robot CNC Machining

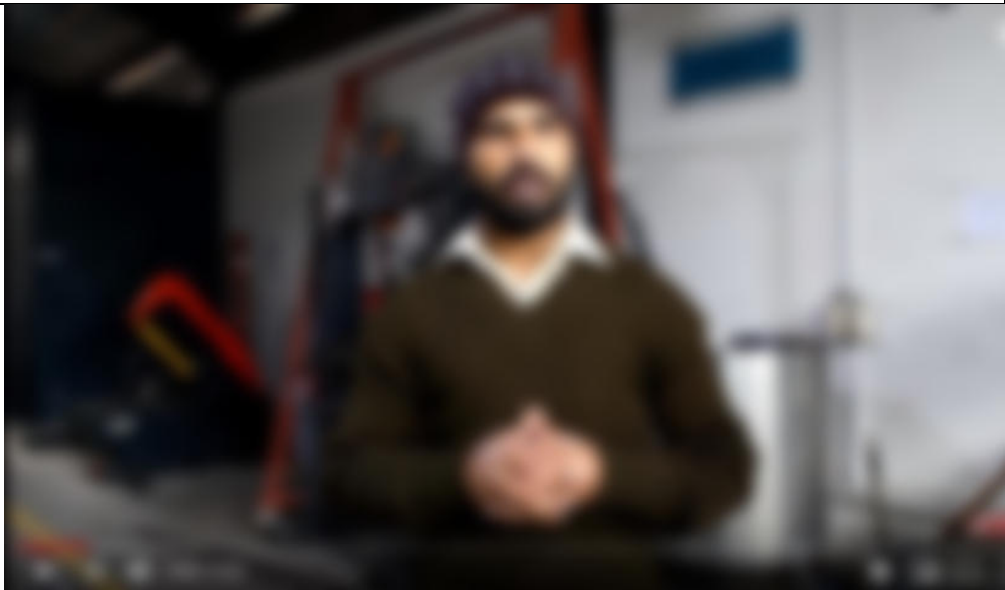
<https://youtu.be/3o1waj2fxgY>

<https://youtu.be/oJPGioHgNjU>



🔥 How to Properly Clean your Metal for Welding

[https://www.youtube.com/watch?v=FF\\_9qGJnXRU](https://www.youtube.com/watch?v=FF_9qGJnXRU)



5 Mistakes Beginners Do in Arc Welding/ Stick Welding

<https://www.youtube.com/watch?v=wp1SkgrdBP8>

## Module: 0714001051 Operate the electronic measuring instruments

### Objective of the Module:

The purpose of this competency standard is to become familiar with different types of electrical and electronic measuring instruments. After completion of this competency standard the candidate will be skilled in taking measurement from different types of electrical and electronic measuring instruments.

|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 50 | Theory: | 20 | Practical | 30 |
|-----------|-------------|----|---------|----|-----------|----|

| Learning Unit                                 | Learning Outcomes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Materials (Tools & Equipment) Required                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Evaluate the measuring instrument</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Classify the instrument type (analogue/digital).</li> <li>Check the type of power source needed.</li> <li>Evaluate and assemble the device and probes with proper procedure (as per manual).</li> <li>Perform zero error tests as described in the procedure.</li> <li>Identify the measuring units/parameters of the device as per SOP.</li> <li>Set the readability of the instrument with respect to range.</li> <li>Record the findings and develop the report.</li> </ul> | <ul style="list-style-type: none"> <li>Demonstrate evaluation procedure</li> <li>Explain Basic instruments and its types.</li> <li>Explain and demonstrate Analog instruments.</li> <li>Explain and demonstrate Digital instruments.</li> <li>Explain and demonstrate operation of analogue measuring instruments</li> <li>AC and DC instruments</li> <li>Direct method measuring instruments</li> <li>Comparison method measuring instruments</li> <li>Indicating instruments</li> <li>Electromechanical instruments</li> <li>Electronic instruments</li> <li>Recording instruments</li> <li>Integrating instruments</li> <li>Explain and demonstrate operation of digital measuring instruments</li> <li>Explain and demonstrate DC power sources</li> <li>Explain and demonstrate AC power Sources</li> <li>understanding of manual and diagrams for assembling the device.</li> <li>explain zero error</li> <li>perform zero error test on device.</li> <li>basic measuring parameter with their units (voltage</li> </ul> | <ul style="list-style-type: none"> <li>Electrical test bench</li> <li>Multi-meter</li> <li>Test probes</li> <li>Hand glove</li> <li>Analogy meter</li> <li>DMM</li> <li>Thermometer</li> <li>2-channel AC/DC</li> <li>Power supply 5V, 12V, 24V</li> <li>Oscilloscope</li> <li>Breadboard trainer</li> <li>Power source (AC/DC)</li> <li>Digital multi meter</li> <li>Lux meter</li> <li>Power meter</li> <li>Power factor</li> </ul> |

|                                         |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                         |                             | <p>current resistance capacitance inductance and frequency)</p> <ul style="list-style-type: none"> <li>• operation of multi range meter.</li> <li>• selection of range with respect to desired parameter.</li> <li>• procedure for recording as per manual of equipment</li> <li>• procedure for reporting</li> </ul> <p><b>Practical:</b><br/>Perform Zero error test.</p>                                                                     | <p>meter,</p> <ul style="list-style-type: none"> <li>• Frequency meter</li> <li>• Energy meter etc.</li> <li>• Electrical test bench</li> <li>• Digital Multi-meter</li> <li>• Digital Power source (AC/DC)</li> <li>• Manual tools</li> <li>• Screw drivers</li> <li>• Tweezers Tool</li> <li>• Wire Cutter</li> <li>• Nose plier</li> <li>• Soldering iron</li> <li>• Sucker</li> <li>• Electrical test bench</li> <li>• Power source (AC/DC)</li> <li>• Oscilloscope</li> <li>• Function generator</li> <li>• IC/components</li> <li>• Gold Aluminum Housed Wire wound Resistor-AH-50W-1k</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>LU2.Operate Analogue instruments</b> | <b>Electrical measuring</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Determine the type of electrical/electronic parameter to be measures.</li> <li>• Select the relevant measuring instrument as per parameter to be measured.</li> <li>• Test point identification for measurement.</li> <li>• Connect the instrument according to the prescribed method.</li> <li>• Follow the procedure for reading value on the display</li> </ul> | <ul style="list-style-type: none"> <li>• Explain overview of measuring parameter</li> <li>• Explain selection procedure of measuring parameter</li> <li>• Explain selection procedure of measuring instrument</li> <li>• Explain procedure for identification of test point</li> <li>• Explain and demonstrate selection of test point</li> <li>• Explain methods of measurement (i.e. voltage current).</li> <li>• Demonstrate connection procedure for measurement</li> <li>• Demonstrate procedure to extract value according to the selected range.</li> <li>• Demonstrate tools required for measurement</li> </ul> <p><b>Practical-1:</b><br/>Find resistance of standard resistor (AH-50w-1k) through analogue multi meter.</p> <p><b>Practical-2:</b><br/>Generate 10volt using variable power supply and then measure it using analogue multi meter</p> <p><b>Practical-3:</b><br/>Apply 10v to standard resistor (AH-50w-1k) and find the current using analogue multi meter</p> |

|                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>LU3. Operate digital measuring instruments</b>                          | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify the type of quantity to be measures.</li> <li>• Select the relevant measuring instrument as per parameter to be measured.</li> <li>• Test point identification for measurement.</li> <li>• Connect the instrument according to the prescribed method.</li> <li>• Follow the procedure for reading value on the display</li> </ul> | <ul style="list-style-type: none"> <li>• Explain overview of measuring parameter</li> <li>• Explain selection procedure of measuring parameter</li> <li>• Explain selection procedure of measuring instrument</li> <li>• Explain and demonstrate procedure for identification of test point</li> <li>• Demonstrate selection of test point</li> <li>• Demonstrate methods of measurement (i.e voltage current).</li> <li>• Demonstrate connection procedure for measurement</li> <li>• Demonstrate procedure to extract value according to the selected range.</li> </ul> <p><b>Practical-1:</b><br/>Find resistance of standard resistor (AH-50w-1k) through digital multi meter.</p> <p><b>Practical-2:</b><br/>Generate 10volt using variable power supply and then measure it using digital multi meter</p> <p><b>Practical-3:</b><br/>Apply 10v to standard resistor (AH-50w-1k) and find the current using digital multi meter</p> | As Unit-1 |
| <b>LU4. Familiarize with basics of oscilloscope and function generator</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify components and control knobs of oscilloscope.</li> <li>• Familiarize with operating panel and display control.</li> <li>• Adjust screen resolution and calibrate screen with probes.</li> <li>• Measure the AC/DC signal on oscilloscope using function generator.</li> </ul>                                                     | <ul style="list-style-type: none"> <li>• Explain Basic functionality of oscilloscope and function generator.</li> <li>• demonstrate screen, control panel and probes</li> <li>• demonstrate working of each knob/button</li> <li>• explain and demonstrate how to extract reading of the signal</li> <li>• demonstrate procedure of calibration of the oscilloscope</li> <li>• Demonstrate procedure for the adjustment of screen resolution</li> <li>• Demonstrate procedure to generate AC signal from function generator</li> <li>• Demonstrate procedure to generate DC signal from</li> </ul>                                                                                                                                                                                                                                                                                                                                       | As Unit-1 |

|  |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  | <p>function generator</p> <ul style="list-style-type: none"> <li>• Demonstrate procedure for connection (oscilloscope with function generator)</li> <li>• Demonstrate procedure for measurement of signal using oscilloscope.</li> </ul> <p><b>Practical-1:</b><br/>Generate 5v RMS 50hz signal using function generator and measure peak voltage, peak to peak voltage, RMS voltage, time period and frequency of that signal using oscilloscope</p> |  |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|                                                                                     |                                                                                                                                     |
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| Module 2:                                                                           |                                                                                                                                     |
|  | <p>Measuring Tools</p> <p><a href="https://www.youtube.com/watch?v=cX5DCzyiz6k">https://www.youtube.com/watch?v=cX5DCzyiz6k</a></p> |



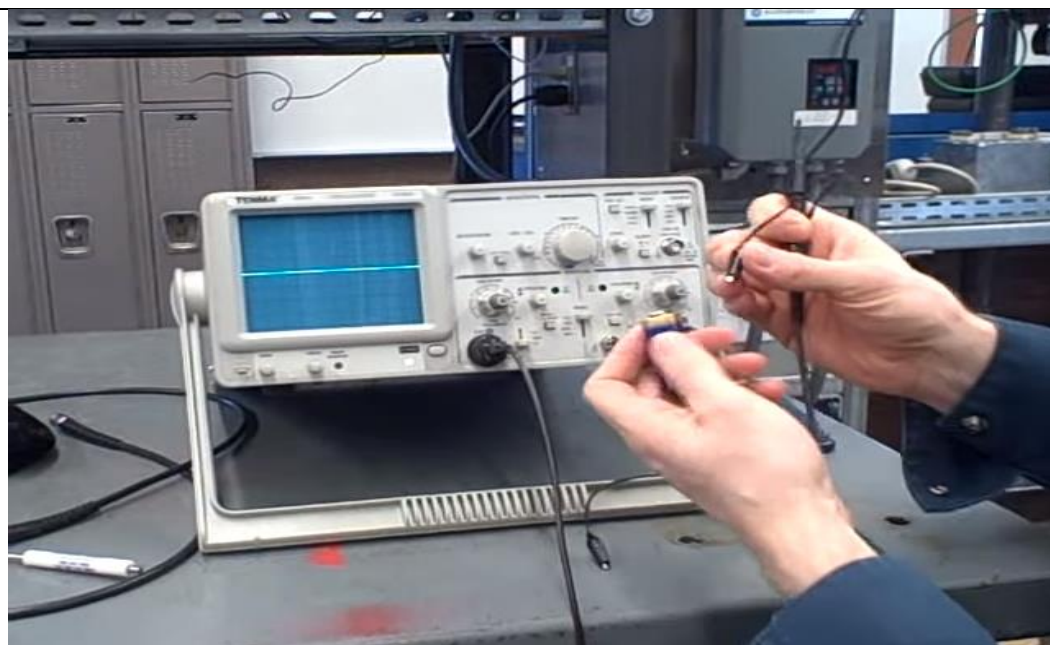
Analog Multimeter, internal electronics circuit components, DC voltage and resistance. Measured.

<https://www.youtube.com/watch?v=agIVTCg4DMA>



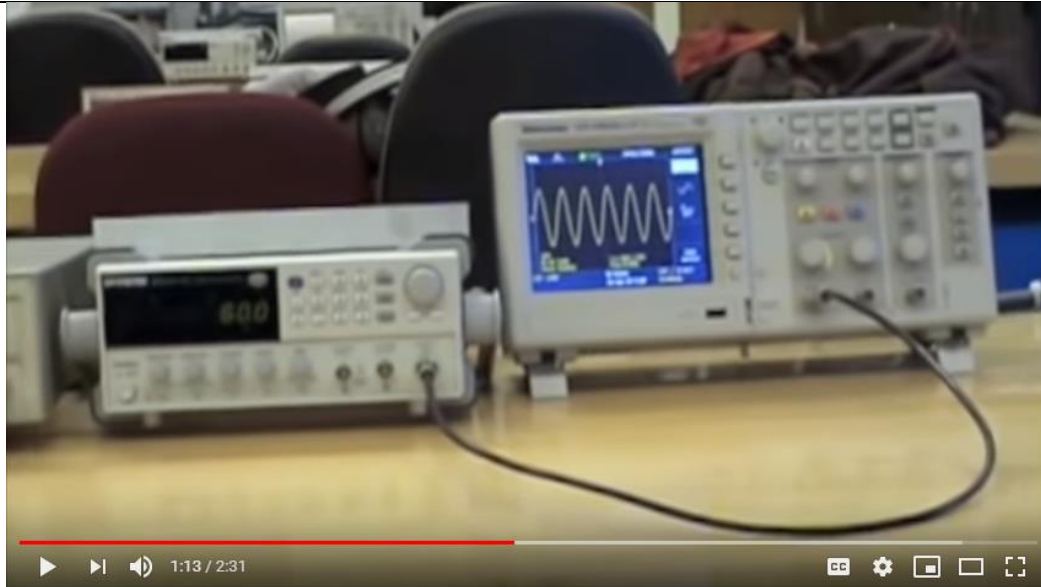
Electrical Measuring Instruments - Testing Equipment Electrical - Types of Electrical Meters

<https://www.youtube.com/watch?v=gkeJzRrwe5k>



Oscilloscope operation differential voltage measurement.

<https://www.youtube.com/watch?v=VWodjUSkYVE>



How to use a Function Generator and Oscilloscope

<https://www.youtube.com/watch?v=jWDJeiH6veQ>



MetrologX4 i-Robot - The first all in one Robotic Measurement Solution

[https://youtu.be/wsM\\_e8HvYw](https://youtu.be/wsM_e8HvYw)

<https://youtu.be/vSX5fvNT3Bo>

## Module: 0714001052 Use measuring instruments for mechanics

### Objective of the Module:

This competency standard covers the skills and knowledge required to take measurements with Steel rule, Hook rule, Folding rule, Trammels, combination set, micrometre, Vernier calliper, various gauges and different measurement instruments.

|           |             |        |         |        |           |        |
|-----------|-------------|--------|---------|--------|-----------|--------|
| Duration: | Total hours | 50 Hrs | Theory: | 14 Hrs | Practical | 36 Hrs |
|-----------|-------------|--------|---------|--------|-----------|--------|

| Learning Unit                                     | Learning Outcomes                                                                                                                                                                                                                                         | Learning Elements                                                                                                                                                                                                                                                                                                                                                 | Materials (Tools & Equipment) Required                                                                                                                                                                                |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1.Take measurements with graduated tools</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>Take measurements using a Steel rule</li> <li>Take measurements using a Hook rule</li> <li>Take measurements using a Folding rule</li> <li>Take measurements with Trammels</li> </ul> | <ul style="list-style-type: none"> <li>Describe units of different measuring parameters.</li> <li>describe the measuring techniques using different measuring equipment's</li> <li>Describe how to develop the own measuring tools under different circumstances</li> <li>demonstrate the levelling of measuring rules to get the appropriate readings</li> </ul> | <ul style="list-style-type: none"> <li>Steel rule</li> <li>Work piece</li> <li>Surface plate</li> <li>Steps and collars</li> <li>Hook rule</li> <li>Folding rule</li> <li>Trammel</li> <li>Combination set</li> </ul> |
|                                                   |                                                                                                                                                                                                                                                           | <b>Practicle-1</b> <ul style="list-style-type: none"> <li>measure the different lengths using different types of measuring rule(s)</li> </ul>                                                                                                                                                                                                                     |                                                                                                                                                                                                                       |

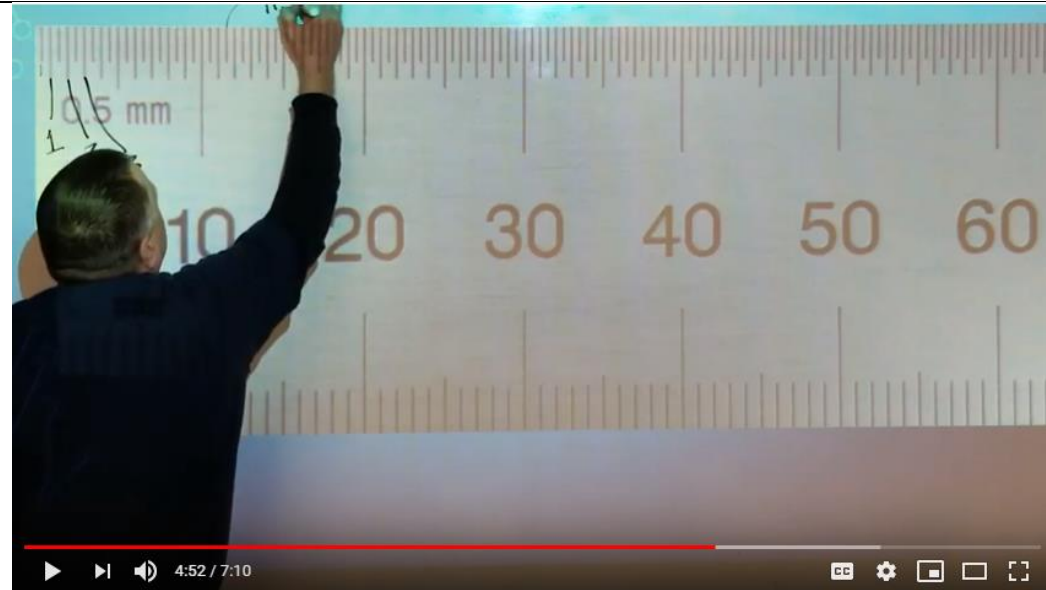
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| <b>LU2.Take measurements with combination set</b>   | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Take Measurement with Square head</li> <li>• Perform levelling with square head as spirit level</li> <li>• Measure depth with square head as depth gauge</li> <li>• Measure height with square head as height gauge</li> </ul> | <ul style="list-style-type: none"> <li>• Explain the types of measuring heads</li> <li>• demonstrate the method to take the appropriate readings from different types of measuring heads</li> </ul> <hr/> <p><b>Practical-1</b></p> <ul style="list-style-type: none"> <li>• measure the depths of industrial parts using measuring heads manufactured by industrial robot</li> <li>• measure the heights for industrial parts manufactured by robot using measuring gauges</li> </ul> | <ul style="list-style-type: none"> <li>• Screw thread Micro meter</li> <li>• Vernier Calliper</li> <li>• Height Gauge</li> <li>• Vernier calliper</li> <li>• Dial thickness gauge</li> <li>• Dial indicator</li> </ul> |
| <b>LU3.Take measurements through various gauges</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Take measurement with fixed gauge and plug gauge.</li> <li>• Take measurement with adjustable gauge</li> <li>• Take measurement with small hole gauge</li> <li>• Take measurement with telescope gauge</li> </ul>              | <ul style="list-style-type: none"> <li>• Explain different types of measuring gauges used under different operating conditions</li> <li>• illustrate the different measuring techniques using measuring gauges</li> <li>• demonstrate how measuring gauges are used while developing the robotic based environment</li> </ul>                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Coordinate measuring machines <ul style="list-style-type: none"> <li>• ISO tables of fits and tolerance</li> <li>• Measurement tools</li> </ul> </li> </ul>                   |

|                                                     |                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                     |                                                                                                                                                                                                                                                                                                                                    | <b>Practical-1</b> <ul style="list-style-type: none"> <li>• Measure the heights of assembly line parts using measuring gauges</li> </ul>                                                                                                                                                                            |                                                                                                                                                                                                |
| <b>LU4.Perform measurements through Micro meter</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Take measurement with outside micro-meter</li> <li>• Take measurement with inside micro meter</li> <li>• Take measurement with depth micro meter</li> <li>• Measure threads with micro meter</li> <li>• Take measurement with Vernier micro meter</li> </ul> | <b>Practical-1</b> <ul style="list-style-type: none"> <li>• Explain working of micro meter</li> <li>• demonstrate the micro meter usage under real time conditions</li> <li>• Explain types of threads measurements using micro meter.</li> <li>• demonstrate the threads measurements using micro meter</li> </ul> | <ul style="list-style-type: none"> <li>• Surface plate</li> <li>• Scriber</li> <li>• Tri square</li> <li>• Divider</li> <li>• Round stock</li> <li>• Fix gauge</li> <li>• Telescope</li> </ul> |
|                                                     |                                                                                                                                                                                                                                                                                                                                    | <b>Practical-1</b> <ul style="list-style-type: none"> <li>• measure the heights of different parts using micro meter while working on lathe machine</li> <li>• measure the necessary heights/lengths/diameters manufactured under robotic environment using micro meters</li> </ul>                                 |                                                                                                                                                                                                |
| <b>LU5. Measure dimensions with Vernier tools</b>   | The trainee must be able to: <ul style="list-style-type: none"> <li>• Take measurement with Vernier calliper</li> <li>• Take measurement with height gauge</li> <li>• Take measurement with Vernier depth gauge</li> </ul>                                                                                                         | <ul style="list-style-type: none"> <li>• Explain working of Vernier tools</li> <li>• demonstrate the Vernier tool usage under real time conditions</li> <li>• describe the types of measurements using Vernier tool</li> </ul>                                                                                      | <ul style="list-style-type: none"> <li>• Surface plate</li> <li>• Radius gauge</li> <li>• Ring Gauge</li> <li>• Plug Gauge</li> <li>• Angle gauge</li> <li>• Adjustable gauge</li> </ul>       |

|                                            |                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                              |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                            |                                                                                                                                                                                                                                                                                                              | <b>Practical-1</b> <ul style="list-style-type: none"> <li>• measure the heights of different parts using Vernier tool while working on lathe machine</li> <li>• measure the necessary heights/lengths/diameters manufactured under robotic environment using Vernier tool</li> </ul>                                                                                     |                                                                                                                                                                                                                                              |
| <b>LU6. Perform different measurements</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Take measurement with dial calliper</li> <li>• Take measurement with dial thickness gauge</li> <li>• Take measurement with dial Indicator</li> <li>• Exercise on gauge blocks</li> <li>• Exercise on tool makers microscope</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the measurements techniques</li> <li>• Describe the types of tolerances &amp; allowances in measurements techniques</li> <li>• Describe the tool maker microscope</li> <li>• Describe and demonstrate the robotic based measurement techniques</li> <li>• Demonstrate the measurements techniques and tools</li> </ul> | <ul style="list-style-type: none"> <li>• Surface gauge</li> <li>• Dial indicator</li> <li>• Outside Micrometer</li> <li>• Inside Micrometer</li> <li>• Depth Micrometer</li> <li>• Gauge blocks</li> <li>• Tool makers microscope</li> </ul> |

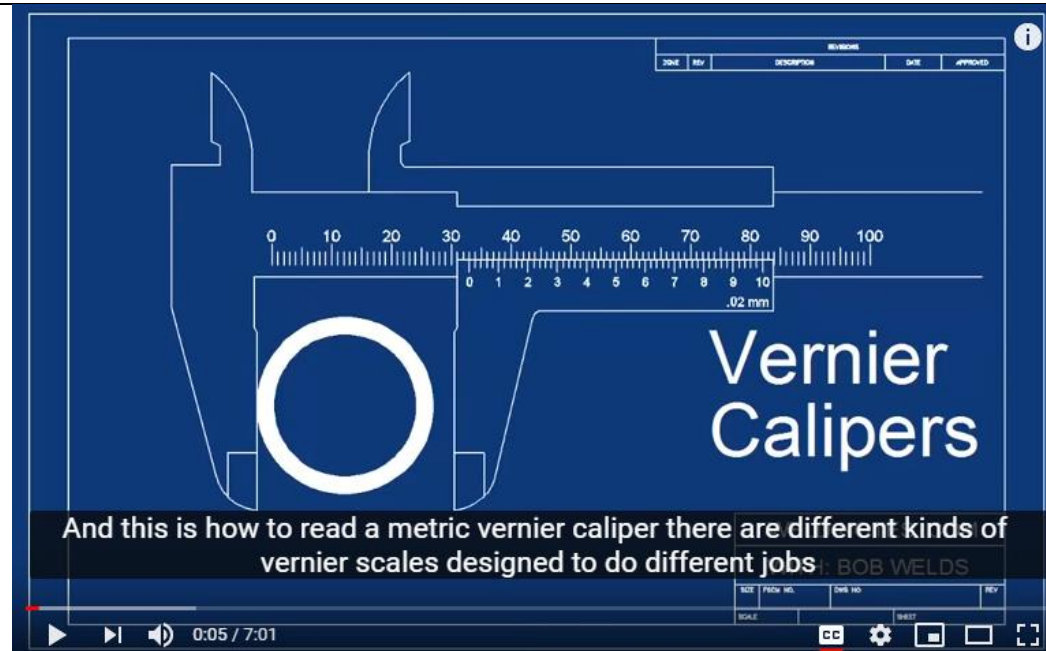
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|  | <ul style="list-style-type: none"> <li>• Practice on Profile Projector</li> <li>• Practice Of Digital Instruments</li> <li>• Measure tolerance and allowances</li> </ul> | <b>Practical-1</b> <ul style="list-style-type: none"> <li>• Measure the robotic based assembled parts using dial calliper/dial thickness gauge/dial indicators/gauge blocks/profile projectors/digital instruments</li> <li>• measure the tolerances &amp; allowances using measuring gauges for robotic based assembled parts</li> </ul> |  |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Examples and illustrations



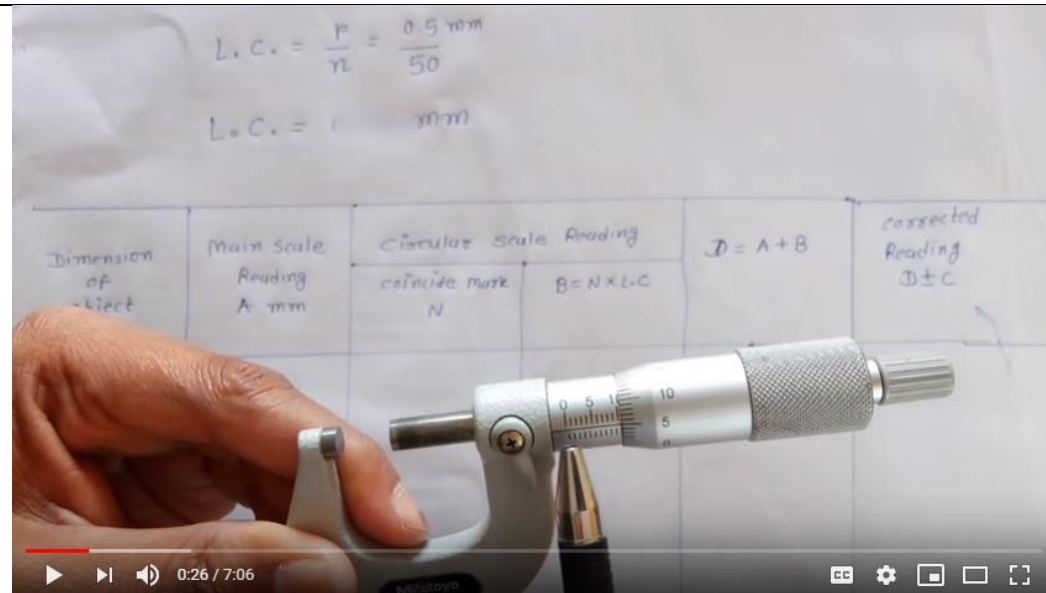
### Reading the Steel Rule

<https://www.youtube.com/watch?v=kIEaoslrVf8>



### How to Read a Metric Vernier Caliper

<https://www.youtube.com/watch?v=vkPlzmalvN4>



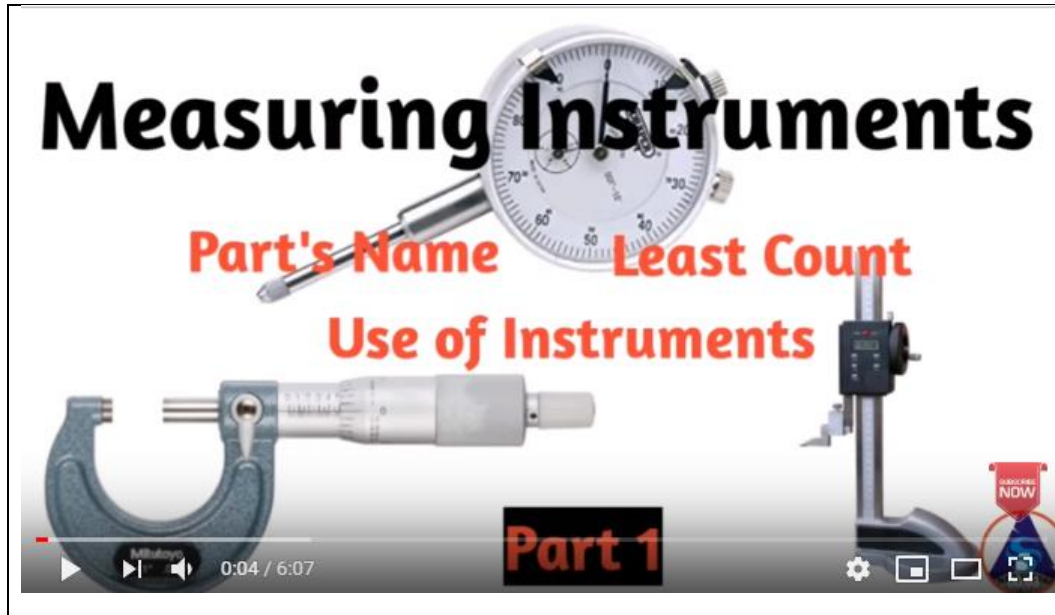
## How to use Micrometer Screw Gauge?

<https://www.youtube.com/watch?v=phFRSS7mH9Y>



## Measuring with a Vernier Caliper

<https://www.youtube.com/watch?v=i-5gEN0N0pk>



Measuring Instruments, Least Count, Parts name and Details

[https://youtu.be/J7fKbrFO\\_y0](https://youtu.be/J7fKbrFO_y0)

<https://youtu.be/lou9kAFGOjk>

## Module: 0714001055 Identify security arrangements for robotics equipment

**Objective of the Module:** The objective of this standard is to ensure identification of security arrangements, assessment of gaps in the current security protocols and report security solutions for robotic equipment. After achieving this standard, the learner will be able to ensure security arrangements for operation of robotic equipment.

|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 40 | Theory: | 13 | Practical | 27 |
|-----------|-------------|----|---------|----|-----------|----|

| Learning Unit                                  | Learning Outcomes                                                                                                                                                                                                                                                                                                                            | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                     | Materials (Tools & Equipment) Required                                                                                                                                                                                        |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Maintain Security logs</b>             | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Keep performance records timely and relevant.</li> <li>Acknowledge both positives and negatives of the recorded activities.</li> <li>Keep the logs factual and detailed.</li> <li>Create a sense of continuity and consistency while maintaining logs.</li> </ul> | <ul style="list-style-type: none"> <li>Describe record keeping procedure.</li> <li>Define elements of record keeping like Time, Date, Errors, check in, check out terms.</li> <li>Describe logs, its types and operations.</li> <li>Demonstrate how to maintain logs</li> <li>Define positive and negative record data.</li> <li>Demonstrate how to compare event based positive and negative data record.</li> </ul> | <ul style="list-style-type: none"> <li>Personal Computers</li> <li>Printer</li> <li>Stationary items</li> <li>Any Robotic Equipment with security protocol manual</li> <li>Log books</li> <li>Desk</li> <li>Chairs</li> </ul> |
|                                                |                                                                                                                                                                                                                                                                                                                                              | <p><b>Practical:</b></p> <p>The candidate is required to prepare proper security logs highlighting significant events as per given workplace data of one week.</p>                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |
| <b>LU2. Follow Relevant Security Protocols</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify relevant security protocols as per standard operating procedures.</li> <li>Follow instructions as per standard operating procedures.</li> </ul>                                                                                                          | <ul style="list-style-type: none"> <li>Define security protocols.</li> <li>Describe limitations of security protocols.</li> <li>Explain all the standard operating procedures.</li> <li>Demonstrate various security protocols.</li> </ul>                                                                                                                                                                            |                                                                                                                                                                                                                               |
|                                                |                                                                                                                                                                                                                                                                                                                                              | <p><b>Practical:</b></p> <p>Get the data from record to identify the security protocols and its standard operating procedure.</p>                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                               |

|                                      |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                           |  |
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| <b>LU3. Audit Security Protocols</b> | <ul style="list-style-type: none"> <li>• Check whether security logs are followed as per standard operating procedures</li> <li>• Assess current security performance</li> <li>• Identify gaps in current security protocols</li> <li>• Formulate and report security solutions to supervisor</li> </ul> | <ul style="list-style-type: none"> <li>• Explain how to check security logs.</li> <li>• Define security performance.</li> <li>• Describe various standard solution for security breach.</li> <li>• Describe how to evaluate performance of security protocol.</li> <li>• Demonstrate comprehensive audit of security protocol.</li> </ul> |  |
|                                      |                                                                                                                                                                                                                                                                                                          | <b>Practical:</b><br>Make a report on existing security protocols of provided workplace environment which includes procedure of checking security protocols and make a comparison with standard procedure.                                                                                                                                |  |

## Examples and illustrations



<https://www.youtube.com/watch?v=dqoZEfJ7UbM>

**Maintain Security logs**



**Robotics Safety | Enabling automation & productivity with safety compliance**

<https://www.youtube.com/watch?v=qkZxyRc0Luk>



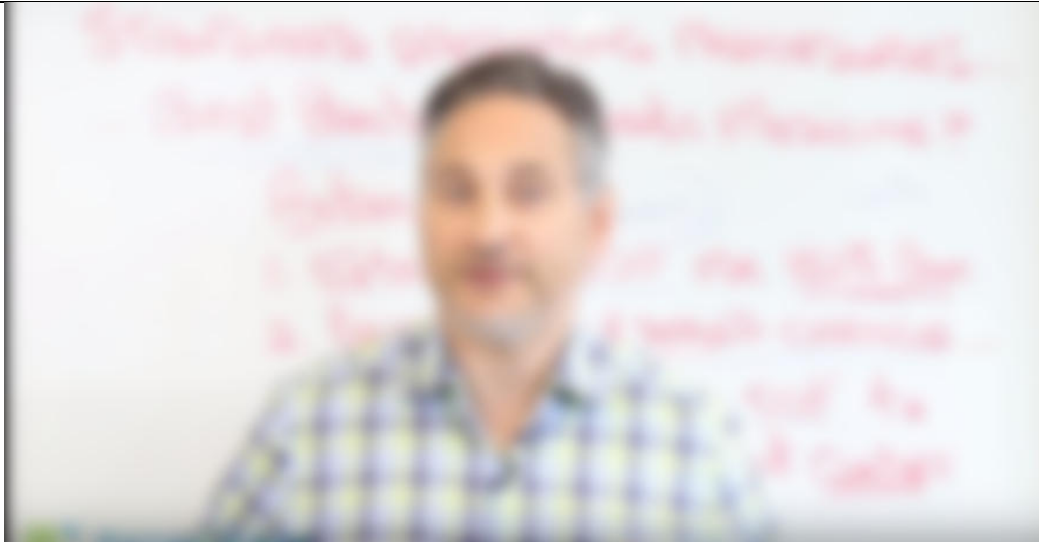
Home and industrial robots can be hacked to hurt humans

<https://www.youtube.com/watch?v=dmrewRojeCE>



This is an example to create log in python, and view its data.

<https://www.youtube.com/watch?v=g8nQ90Hk328>



### Follow Relevant Security Protocols

<https://www.youtube.com/watch?v=F3Up7iizq9I>



### Audit Security Protocols

<https://www.youtube.com/watch?v=BxHYtFIKruY>

## Module: 0714001056 Operate Robots at workplace

**Objective of the Module:** This module relates with basic operation of robots in industry and identifies learning required for operation of robot at workplace as per standard operating procedures provided in the user manual. Trainee will be able to perform basic operation of a robot.

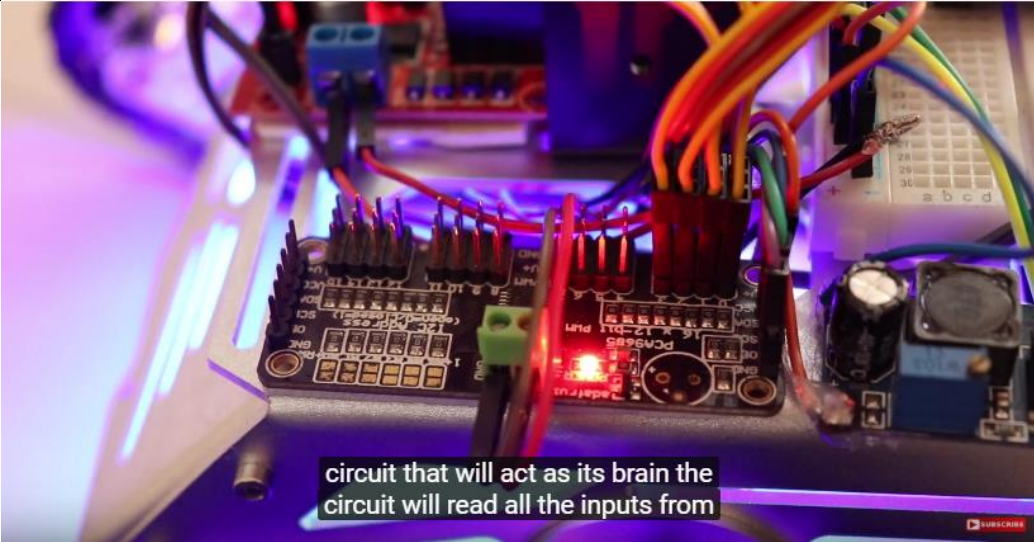
|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 50 | Theory: | 14 | Practical | 36 |
|-----------|-------------|----|---------|----|-----------|----|

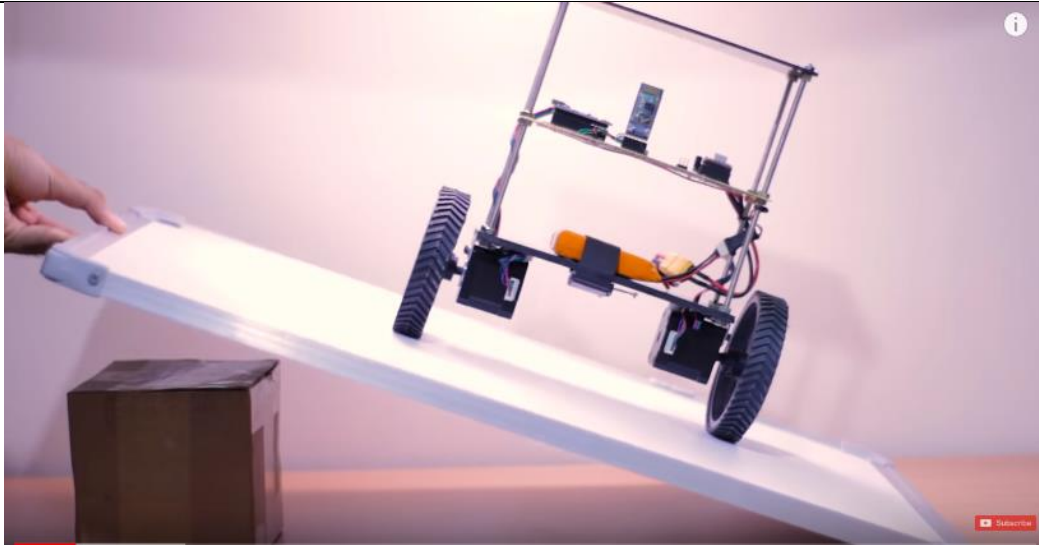
| Learning Unit                                             | Learning Outcomes                                                                                                                                                                                                                                                                                                                       | Learning Elements                                                                                                                                                                                                                                                        | Materials (Tools & Equipment) Required                                                                    |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>LU1.Perform basic/initial test before operation</b>    | The trainee must be able to: <ul style="list-style-type: none"> <li>• Knowledge about basic working of given component</li> <li>• Ensure proper connectivity of all components according to instructions</li> <li>• Check initial power indicators</li> <li>• Perform basic calibration of robot</li> <li>• Perform test run</li> </ul> | <ul style="list-style-type: none"> <li>• Describe different robot components and their connectivity</li> <li>• Indicate different types of indicator</li> <li>• Explain initial calibrations and pre-operative test procedure</li> <li>• Demonstrate test run</li> </ul> | <ul style="list-style-type: none"> <li>• Robotic Platform</li> <li>• Basic electronic Tool Kit</li> </ul> |
|                                                           |                                                                                                                                                                                                                                                                                                                                         | <b>Practical-1:</b><br>Perform test run by ensuring components connected by looking at respective indicators                                                                                                                                                             |                                                                                                           |
| <b>LU2. Ensure Suitability of workplace for operation</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify suitable work environment for the robot.</li> <li>• Identify obstacles that effects robot operations</li> </ul>                                                                                                                                          | <ul style="list-style-type: none"> <li>• Explain suitable work environment and environmental hazardous</li> <li>• Describe robotic equipment safety</li> <li>• Demonstrate a suitable environment for given robot safety.</li> </ul>                                     |                                                                                                           |

|                                                                |                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                   |  |
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|                                                                | <ul style="list-style-type: none"> <li>• Prepare suitable work environment for the robot.</li> <li>• Ensure safety for the robotic equipment.</li> </ul>                                                                                                                                                                                       | <b>Practical-1:</b><br>Prepare suitable environments for given robot ensuring robot safety                                                                                                                        |  |
| <b>LU3. Follow standard procedures for operating the robot</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Know about operation manuals of robot</li> <li>• Identify the standard operating procedure for the robot.</li> <li>• Follow instruction as given in standard operating procedure while operating the robot</li> <li>• Ensure proper functioning of the robot.</li> </ul> | <ul style="list-style-type: none"> <li>• Explain robots operating manual and its standard operating procedure</li> <li>• Demonstrate robot basic functioning according to standard operating procedure</li> </ul> |  |
|                                                                |                                                                                                                                                                                                                                                                                                                                                | <b>Pactical-1:</b><br>Identify and Perform any basic operation of a given robot as per standard operating procedure.                                                                                              |  |
| <b>LU4. Perform post operation test</b>                        | The trainee must be able to: <ul style="list-style-type: none"> <li>• Recognize appropriate post operation test for the particular robot</li> <li>• Follow standard operating procedure</li> </ul>                                                                                                                                             | <ul style="list-style-type: none"> <li>• Describe post-operative tests</li> <li>• Demonstrate post-operative test as per standard operating manual.</li> </ul>                                                    |  |

|  |                                                                                                                        |                                                                                                                                 |  |
|--|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--|
|  | to perform post operation test <ul style="list-style-type: none"> <li>• Generate post operation test report</li> </ul> | <b>Practical-1:</b><br>Perform post-operative test for given robot as per Standard operating procedure and generate test report |  |
|--|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|--|

## Example And Illustration

|                                                                                                                                                                         |                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>circuit that will act as its brain the circuit will read all the inputs from</p> | <p><b>Perform basic/initial test before operation</b></p> <p><a href="https://www.youtube.com/watch?v=MR_Y_WT8lhU&amp;list=PL4q1oAdmuCfqmYvURLzVFkMMUI7839biN&amp;index=2">https://www.youtube.com/watch?v=MR_Y_WT8lhU&amp;list=PL4q1oAdmuCfqmYvURLzVFkMMUI7839biN&amp;index=2</a></p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



**Ensure Suitability of workplace for operation**

<https://www.youtube.com/watch?v=I6z26LVu5y0>

## Risk Assessment



**Follow standard procedures for operating the robot**

<https://www.youtube.com/watch?v=GtNKX4kpC18>

## Robot Framework

### Write Test Case with POST request

- 1: POST Request to add new resource
- 2: Pick and Save Response
- 3: Validate Status Code
- 4: Validate Response Content

**Call/Whatsapp for complete videos**  
For Training | Project Support  
Email: [testingworldindia@gmail.com](mailto:testingworldindia@gmail.com)  
Call | Whatsapp: +91-8743-913-121  
Robot Framework | Python | Selenium | SoapUI | Jmeter |  
Appium | LoadRunner | Protractor etc by working professionals

## Perform post operation test

<https://www.youtube.com/watch?v=nrY7usa22Xo>

FT



## Robots in the workplace

<https://www.youtube.com/watch?v=dy96c2Ykd-k>



**Robots in the workplace: Learning to trust electronic co-workers**

<https://www.youtube.com/watch?v=S-koF1WFgbE>

## Module: 0714001057 Distinguish equipment/components for assembling purpose

**Objective of the Module:** Robot parts include a wide variety of components related to: Manipulator, End-effector, Locomotion Device, Controller, Sensors. This competency aims at distinguishing different tools and components involved in assembly of a robot at workplace and also involves prior preparation.

|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 40 | Theory: | 10 | Practical | 30 |
|-----------|-------------|----|---------|----|-----------|----|

| Learning Unit                                          | Learning Outcomes                                                                                                                                                                                                                | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Materials (Tools & Equipment) Required                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Identify different components for assembly</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>List all assembly components</li> <li>Distinguish between different types of components based on various traits.</li> <li>Label components</li> </ul> | <ul style="list-style-type: none"> <li>Explain assembly procedure</li> <li>Explain basic functionality and usage of components</li> <li>Explain procedure for selecting components</li> <li>Demonstrate procedure for selecting components</li> <li>Explain Characteristics of robotic component</li> <li>Explain Procedure for labelling the component</li> <li>Demonstrate Procedure for labelling the component</li> </ul> <p><b>Practical:</b><br/>select all components as per given sheet for assembly and differentiate mechanical &amp; electrical components.</p> | <ul style="list-style-type: none"> <li>Mechanical tools: Hammer, Screwdrivers &amp; Wrenches, Saw, Square, measuring tape, Vernier callipers, Files, Centre Punch, Drill Press, Hobby Tool, soldering station, wires stripper, Sharp utility knives, Hot glue guns, Arc Welder, Electric Heat Gun, Safety Goggles.</li> </ul> |
| <b>LU2. Arrange components in order for assembly</b>   | <p>The trainee must be able to:</p>                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Explain procedure of selecting components as per manual</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>Robot components kit related to: Manipulator, Actuator, End effector, Locomotion Device, Controller, Sensors</li> </ul>                                                                                                                                                                |

|                                                    |                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                    | <ul style="list-style-type: none"> <li>• Know about components from user manual</li> <li>• Identify order of assembly</li> <li>• Recognize required components</li> <li>• Arrange components according to identified order</li> </ul> | <ul style="list-style-type: none"> <li>• Demonstrate procedure of selecting components as per manual</li> <li>• Explain procedure to extract key points for assembly.</li> <li>• Demonstrate procedure to extract key points for assembly.</li> <li>• Explain recognition procedure</li> <li>• Explain procedure for identifying order of assembly</li> <li>• Demonstrate procedure for identifying order of assembly</li> <li>• Explain procedure for arranging components</li> <li>• Demonstrate procedure for arranging components</li> </ul> <p><b>Practical:</b><br/>Arrange all components for assembly as per Task</p> |           |
| <b>LU3. Identify tools/ equipment for assembly</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• List different types of tools</li> <li>• Select appropriate tools for assembly</li> </ul>                                                                | <ul style="list-style-type: none"> <li>• Explain basic functionality and usage of tools/equipment</li> <li>• Explain procedure for selecting tools/equipment</li> <li>• Demonstrate procedure for selecting tools/equipment</li> </ul> <p><b>Practical:</b><br/>select all the tools for assembly as per task and differentiate mechanical &amp; electrical components.</p>                                                                                                                                                                                                                                                   | As Unit-1 |

|                                                         |                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>LU4. Arrange tools/equipment for assembly</b>        | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Arrange tools according to identified order</li> </ul>                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• Explain procedure for arranging tools as per assembly</li> <li>• Demonstrate procedure for arranging tools as per assembly</li> </ul> <p><b>Practical:</b><br/>Arrange all the tools for assembly as per given task</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>As Unit-1</p> |
| <b>LU5. Prepare workspace /environment for assembly</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Check space availability</li> <li>• Arrange racks for the equipment</li> <li>• Place components based on functionality</li> <li>• Ensure safety measures</li> <li>• Ensure availability of consumables</li> <li>• Ensure backup power source</li> </ul> | <ul style="list-style-type: none"> <li>• Explain and demonstrate various space requirement for various assemblies</li> <li>• Explain types of racks used for assembly.</li> <li>• Demonstrate Procedure to arrange racks for assembly.</li> <li>• Demonstrate arrangement of component as per assembly procedure</li> <li>• Explain and demonstrate health and safety procedure (for equipment as well as personnel safety)</li> <li>• Explain Difference Between tools and consumables</li> <li>• Demonstrate Procedure for selecting the consumables.</li> <li>• demonstrate procedure for cross checking of the consumable with standard list.</li> <li>• Explain various power sources and its backup</li> </ul> | <p>As Unit-1</p> |

|  |  |                                                                                                                    |  |
|--|--|--------------------------------------------------------------------------------------------------------------------|--|
|  |  | usage. <ul style="list-style-type: none"> <li>• demonstrate procedure for using of backup power source.</li> </ul> |  |
|  |  | <b>Practical:</b><br>prepare a workspace for given robotic assembly                                                |  |

## Example And Illustration

Identify different components for assembly

[https://www.youtube.com/watch?v=JD9v2zR\\_MRw](https://www.youtube.com/watch?v=JD9v2zR_MRw)

### Basic Component of Robot.

#### a] Manipulator Linkage

- It is a set of links - connected by joints.
  - Rotatory or Sliding
- Last link → end effector
  - Ex. Gripper

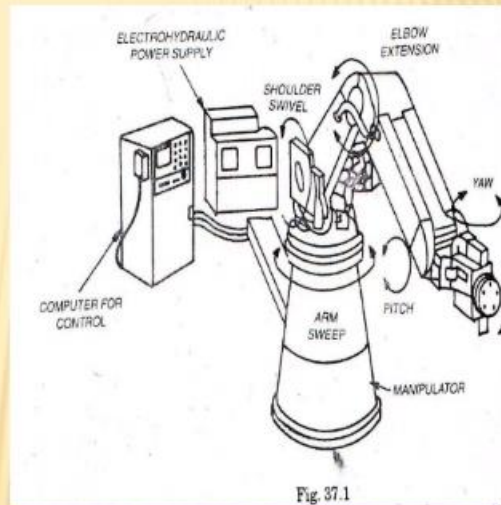
#### b] Actuators

- It actually help to give motion to all links [joints] or component of Robots
- Linear or Rotatory Actuator
- Electrical, Pneumatic or hydraulic power.

## BASIC ELEMENTS OF ROBOT

A robot system consistence of four major elements as shown in fig.

- 1) controller
- 2) robot arm or manipulator
- 3) end of arm tool or end effectors
- 4) power source



Arrange components in order for assembly

<https://www.youtube.com/watch?v=yJcRlzYcW5c>

Identify tools/ equipment for assembly

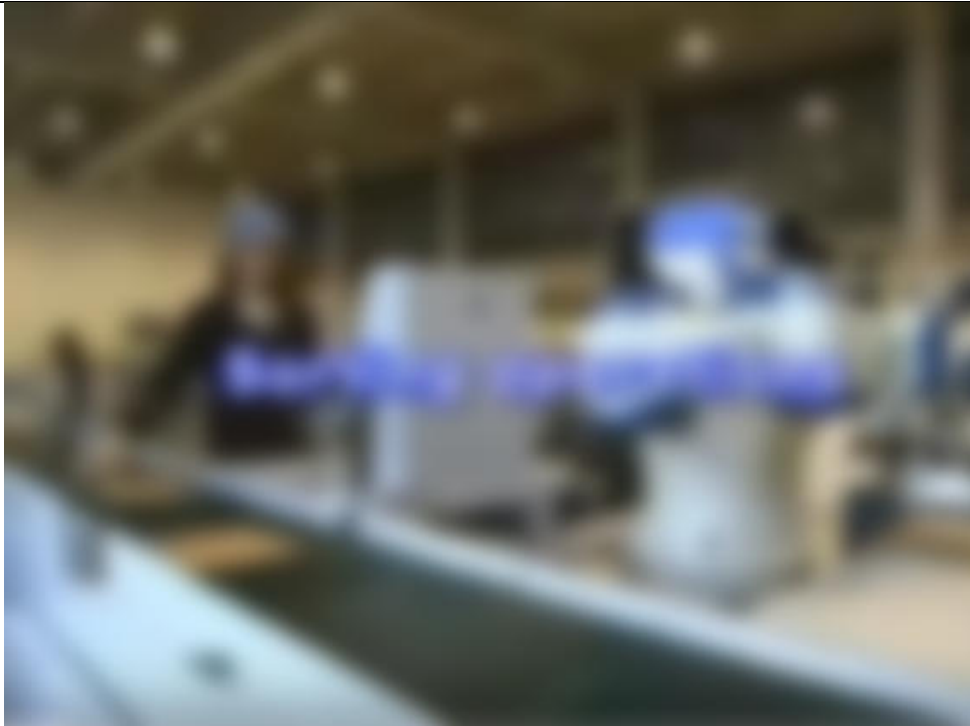
<https://www.youtube.com/watch?v=FltOFBCzx-w>





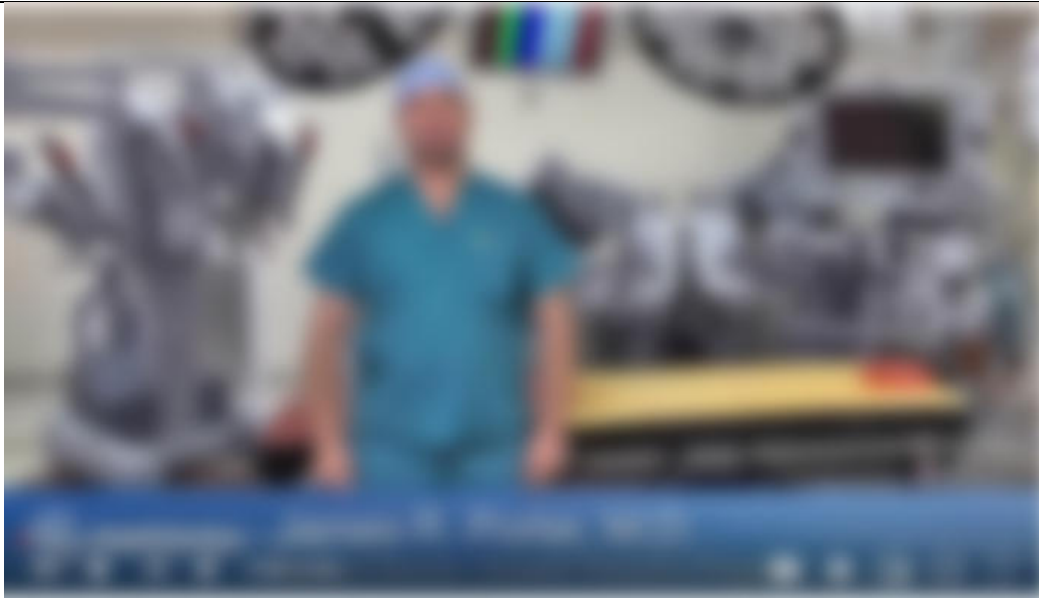
**Arrange tools/equipment for assembly**

<https://www.youtube.com/watch?v=FltOFBCzx-w>



**Prepare workspace /environment for assembly**

<https://www.youtube.com/watch?v=rDvggSDj4Sk>



### The da Vinci Integrated Robotic Surgery Suite at Swedish

<https://www.youtube.com/watch?v=WhDQgRDOA4k>



### Meet Germany's first robot lecturer | DW Documentary

[https://www.youtube.com/watch?v=Amfrm2V\\_KO0](https://www.youtube.com/watch?v=Amfrm2V_KO0)



## High-Speed Robots Part 2: Kiva Robots in the Workplace & in our E-commerce Economy-The Window-WIRED

<https://www.youtube.com/watch?v=qU4YMDJNzpg>

## Module: 0714001058 Do component testing for robotics

**Objective of the Module:** This module deals with preparation of testing work bench, execute component testing for robotics and checking calibration status of the work bench. The learner will be able to perform component testing using the work bench and prepare a calibration report of test work bench after completing this competency level.

| Duration:                                | Total hours                                                                                                                                                                                                                 | 40                                                                                                                                                                                                                                                                | Theory: | 10 | Practical                                                                                                                                                                                           | 30 |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| Learning Unit                            | Learning Outcomes                                                                                                                                                                                                           | Learning Elements                                                                                                                                                                                                                                                 |         |    | Materials (Tools & Equipment) Required                                                                                                                                                              |    |
| LU1. Prepare testing work bench          | The trainee must be able to: <ul style="list-style-type: none"><li>Identify work bench components</li><li>Identify testing criteria according to given standard</li><li>Follow instructions to prepare test bench</li></ul> | <ul style="list-style-type: none"><li>Explain Basic testing concepts</li><li>Demonstrate Basic testing concepts</li><li>Explain Testing Types</li><li>Explain Hierarchical workbench component details</li><li>Demonstrate Develop Criteria for testing</li></ul> |         |    | <ul style="list-style-type: none"><li>Testing Work Bench</li><li>Testing Components of robot</li><li>Electrical tool kit</li><li>Mechanical tool kit</li><li>Computers</li><li>Stationary</li></ul> |    |
|                                          |                                                                                                                                                                                                                             | <b>Practice:</b> <ul style="list-style-type: none"><li>Collect all workbench component details for testing as per given task.</li><li>Develop testing criteria for the given task.</li></ul>                                                                      |         |    |                                                                                                                                                                                                     |    |
| LU2. Identify SOPs for component testing | <ul style="list-style-type: none"><li>Identify components that requires testing</li><li>Identify relevant testing procedures</li><li>List SOPs according to testing criteria</li></ul>                                      | <ul style="list-style-type: none"><li>Describe SOPs for identification of component that required testing</li><li>Demonstrate the testing procedure as per SOP.</li></ul>                                                                                         |         |    |                                                                                                                                                                                                     |    |
|                                          |                                                                                                                                                                                                                             | <b>Practical</b> <ul style="list-style-type: none"><li>perform testing of the given system as per SOP</li></ul>                                                                                                                                                   |         |    |                                                                                                                                                                                                     |    |

|                                    |                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>LU3. Execute component test</b> | <ul style="list-style-type: none"> <li>• Follow SOPs to perform component tests</li> <li>• Identify and log different performance parameters</li> <li>• Ensure safety parameters while component testing</li> <li>• Collect and compile test results</li> <li>• Validate test results</li> </ul> | <ul style="list-style-type: none"> <li>• Describe Execution order for component test</li> <li>• Describe performance and safety parameters of individual components</li> <li>• Demonstrate performance and safety parameters of individual components</li> <li>• Perform Validation of test result and generate report as per results.</li> </ul><br><b>Practical:</b> <ul style="list-style-type: none"> <li>• Validate component testing</li> <li>• Write Performance and safety parameters of component testing of given task</li> <li>• Collect and compile test results</li> </ul> | As Unit-1 |
| <b>LU4. Report testing results</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify relevant templates for report writing</li> <li>• Prepare report on</li> </ul>                                                                                                                                     | <ul style="list-style-type: none"> <li>• Explain report writing and its techniques.</li> <li>• Explain Report Writing on performance parameters and component faults</li> <li>• Demonstrate Report Writing on performance parameters and component faults</li> <li>• Describe component fault specific solution</li> <li>• Demonstrate fault rectification.</li> </ul>                                                                                                                                                                                                                  | As Unit-1 |

|                                                                   |                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                                                                   | <p>performance parameters</p> <ul style="list-style-type: none"> <li>• Prepare report on component faults</li> <li>• Report recommended solutions</li> </ul>                                                                                                                                                                                                                    | <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Write Report on Performance parameters and write possible solutions</li> </ul>                                                                                                                                                                                                                                                                                        |                  |
| <p><b>LU5. Verify Calibration status of testing equipment</b></p> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify absolute instrument for calibration</li> <li>• Identify Calibration parameters</li> <li>• Perform calibration test according to instructions</li> <li>• Compare calibration status with the instruction's manual</li> <li>• Report calibration status of the testing equipment</li> </ul> | <ul style="list-style-type: none"> <li>• Explain calibration testing</li> <li>• Demonstrate calibration testing</li> <li>• Explain verification of calibration testing</li> <li>• Demonstrate verification of calibration testing</li> <li>• Describe the calibration parameters</li> <li>• Demonstrate how to perform calibration test according to instructions and compare calibration status with the instruction manual</li> </ul> | <p>As Unit-1</p> |
|                                                                   |                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Perform calibration test according to instructions and compare calibration status with instruction manual and generate the test report.</li> </ul>                                                                                                                                                                                                                    |                  |

## Exampel And Illustration

|                                                                                                    |                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <h3>Agenda</h3>  | <h3>Prepare testing work bench</h3> <p><a href="https://www.youtube.com/watch?v=n6nxTBB16ag">https://www.youtube.com/watch?v=n6nxTBB16ag</a></p> |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                                                                        |                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <h3>RPA Tools</h3>  | <h3>Identify SOPs for component testing</h3> <p><a href="https://www.youtube.com/watch?v=kVtgA_PQ5R4">https://www.youtube.com/watch?v=kVtgA_PQ5R4</a></p> |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|

## RPA Tools

UiPath blueprism



you can practice the RPA technology

## Execute component test

[https://www.youtube.com/watch?v=kVtgA\\_PQ5R4](https://www.youtube.com/watch?v=kVtgA_PQ5R4)

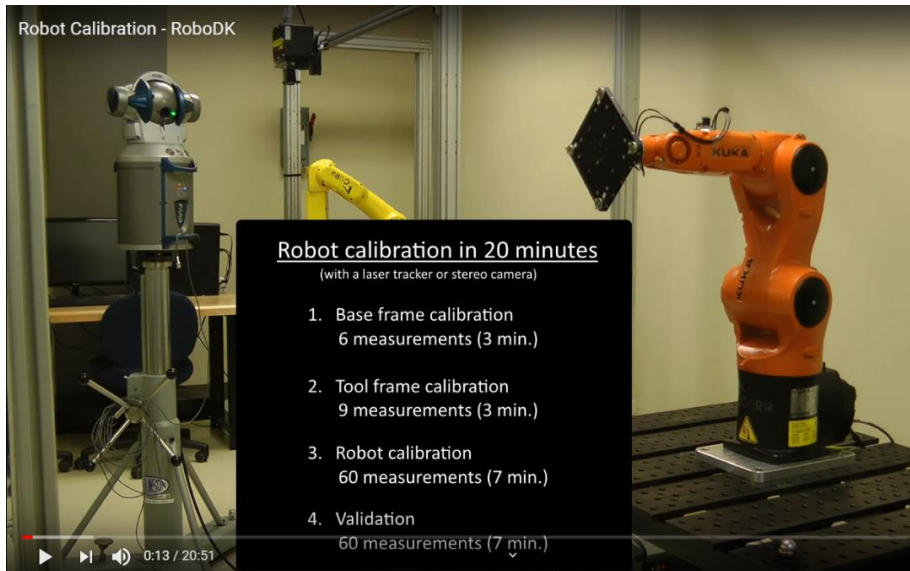
## Report testing results

<https://www.youtube.com/watch?v=sTGcpeDJWMQ>

UI Path

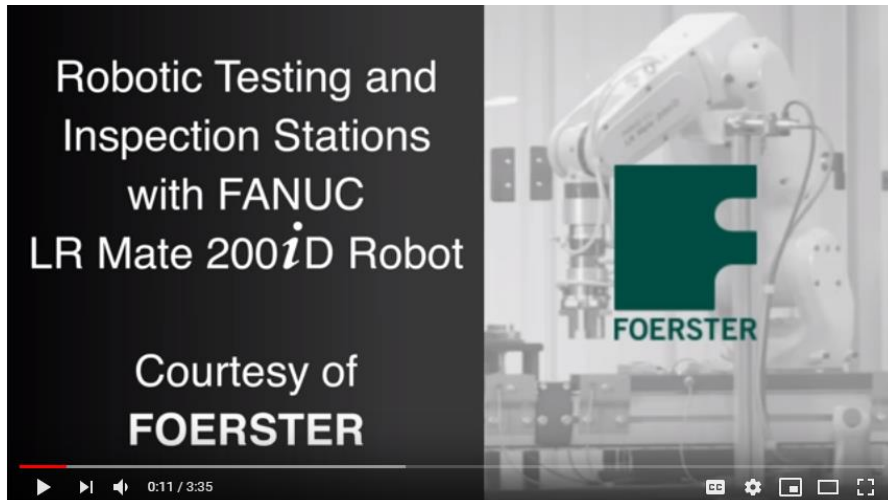
How to read excel data

By Vivek



## . Verify Calibration status of testing equipment

<https://www.youtube.com/watch?v=DWSqZAFaJ2I>



## FOERSTER Robotic Testing and Inspection Stations with FANUC LR Mate 200iD Robot

[https://www.youtube.com/watch?v=t\\_ELuYRlpzY&feature=youtu.be](https://www.youtube.com/watch?v=t_ELuYRlpzY&feature=youtu.be)



## Building a Testbed for FTC Robot Components

<https://www.youtube.com/watch?v=IzUGEZjWK-I>

### Module: 0714001059 Un Deploy robot at workplace

**Objective of the Module:** This Competency Standard is developed to train how to halt operation and uninstall robot at workplace for undeployment. After completing this standard, the trainee will be able to halt the operation, uninstall and undeploy the robot at workplace and efficiently transport it to the proper storage place.

|           |             |    |         |   |           |    |
|-----------|-------------|----|---------|---|-----------|----|
| Duration: | Total hours | 40 | Theory: | 7 | Practical | 33 |
|-----------|-------------|----|---------|---|-----------|----|

| Learning Unit                       | Learning Outcomes                                                                                                                                                                                                                                        | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                           | Materials (Tools & Equipment) Required                                                                                                                     |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Halt operation of robot</b> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify procedure for shutting down of robot.</li> <li>Follow steps provided in standard operating manual.</li> <li>Ensure safety standards during the procedure.</li> </ul> | <ul style="list-style-type: none"> <li>Describe different procedures for shutting down of robot.</li> <li>Describe different standards that should be followed.</li> <li>Demonstrate safety procedures.</li> <li>Demonstrate procedures for shutting down the robot.</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>Given a robot from a specific robotic platform, execute shutdown operation while</li> </ul> | <ul style="list-style-type: none"> <li>Electronic tool kit</li> <li>Mechanical tool kit</li> <li>Robotic Platform</li> <li>Transportation means</li> </ul> |

|                                                                         |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                         |                                                                                                                                                                                                                                                                                             | ensuring that safety standards are followed.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |
| <b>LU2. Prepare environment for undeployment</b>                        | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify tools and equipment required for undeployment</li> <li>• Arrange tools and equipment required</li> <li>• Ensure suitability of workplace for undeployment</li> </ul>                                  | <ul style="list-style-type: none"> <li>• Describe the tools and equipment generally used for un-deployment</li> <li>• Describe process for prepare the workplace for undeployment</li> <li>• Demonstrate the usage of tools and equipment generally used for undeployment</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Given a robot from a specific robotic platform, identify the required tools and equipment. Also prepare the workplace for undeployment</li> </ul> | As Unit-1 |
| <b>LU3. Uninstall robot</b>                                             | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify uninstallation procedure for robot from installation manual.</li> <li>• Follow standard procedure to uninstall the robot</li> <li>• Ensure safety of robotic components while uninstalling</li> </ul> | <ul style="list-style-type: none"> <li>• Describe installation manual</li> <li>• Describe standard procedure for uninstalling a robot</li> <li>• Describe safety procedures for uninstalling robots</li> <li>• Demonstrate uninstallation of robot</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Given a robot from a specific robotic platform, perform uninstallation according to standard procedure</li> </ul>                                                        | As Unit-1 |
| <b>LU4. Prepare components for transportation and storage (packing)</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify packaging requirement of components</li> <li>• Ensure proper packaging of components</li> <li>• Arrange components for transportation and storage.</li> </ul>                                         | <ul style="list-style-type: none"> <li>• Describe materials and methods for packaging</li> <li>• Describe transportation procedure</li> <li>• Describe storage procedures</li> <li>• Demonstrate proper packaging of robot component</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Given a robot component, perform proper packaging of the component</li> </ul>                                                                                                          | As Unit-1 |
| <b>LU5. Transport and store components</b>                              | <p>The trainee must be able to:</p>                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>• Describe various modes of transportation for robotic components</li> <li>• Describe standard procedures for loading and unloading of components</li> </ul>                                                                                                                                                                                                                                                                                                      | As Unit-1 |

|  |                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                    |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <ul style="list-style-type: none"> <li>• Identify mode of transportation.</li> <li>• Ensure safe loading /unloading of the robotic components</li> <li>• Ensure appropriate storage environment for components</li> </ul> | <ul style="list-style-type: none"> <li>• Describe various storage procedures for components</li> <li>• Demonstrate transportation of robotic component</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Given a robotic component, transport it to storage area for storage</li> </ul> |  |
|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Example and Illustration



High-Speed Robots Part 2: Kiva Robots in the Workplace & in our E-commerce Economy-The Window-WIRED

<https://www.youtube.com/watch?v=qU4YMDJNzpg&feature=youtu.be>



## Prepare environment for undeployment

<https://www.youtube.com/watch?v=TUmyyqCMMGA>



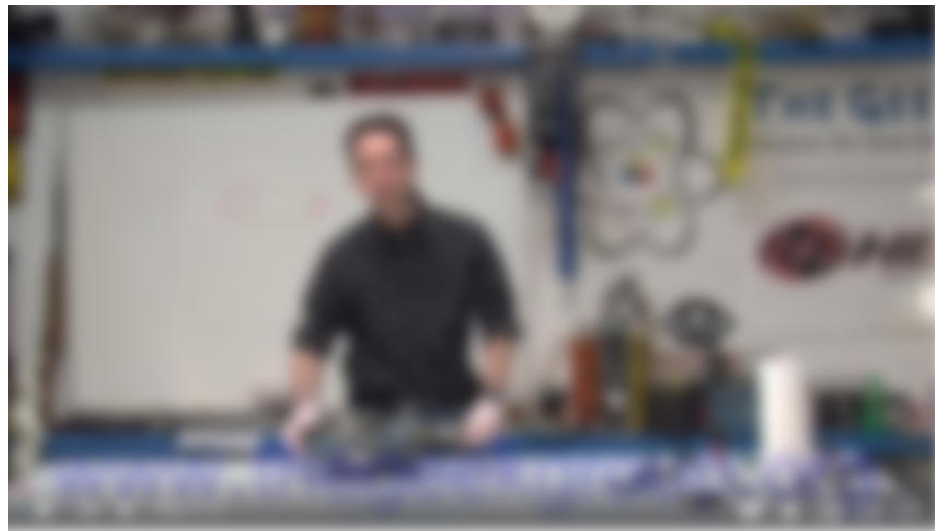
## Uninstall robot

<https://www.youtube.com/watch?v=F8X-Z6Sti1A>



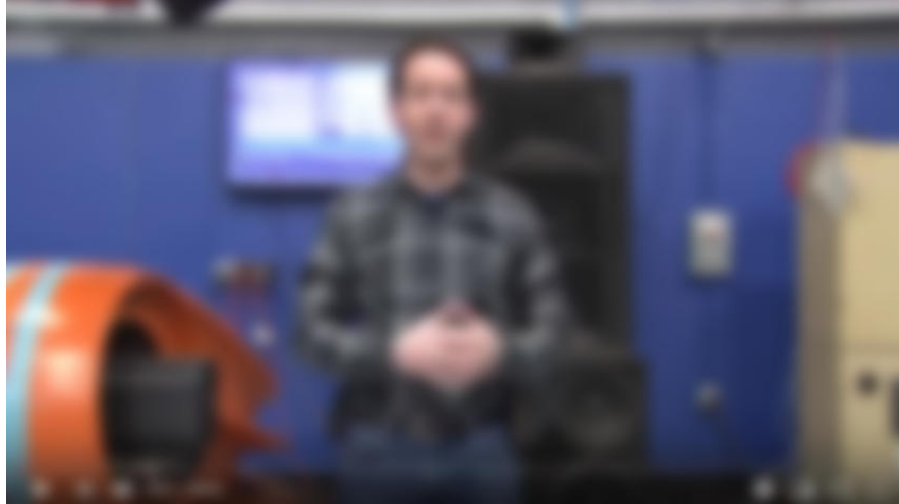
### Prepare components for transportation and storage (packing)

<https://www.youtube.com/watch?v=l4naUx5OAJU>



### Inside Axis 4,5 and 6 on a KUKA Robotic Arm

<https://www.youtube.com/watch?v=EfmjhfN8D-Q>



## Fixing a KUKA KR-350/1 Robotic Arm: Part 1

[https://www.youtube.com/watch?v=6YiPrytt\\_Ss](https://www.youtube.com/watch?v=6YiPrytt_Ss)

1. Know your power tool—Read the owner's manual carefully. Learn its application and limitations as well as the specific potential hazards peculiar to this tool.
2. Ground all tools—If a tool is equipped with a three-prong plug, it should be plugged into a three-hole receptacle. If an adapter is used to accommodate a two-prong receptacle, the adapter wire must be attached to a KNOWN GROUND. Never remove the third prong.
3. Keep guards in place—and in working order.
4. Remove adjusting keys and wrenches—Form a habit of checking to see that keys and adjusting wrenches are removed from the tool before turning on any machine.
5. Keep work area clear—Cluttered work areas and benches invite

## Halt operation of robot:

accidents.

6. Avoid a dangerous work environment—Do not use power tools in damp or wet

locations. Keep your work area well illuminated.

7. Keep children away—All visitors should be kept a safe distance from the work area.

8. Make your workshop “kid-proof” —with padlocks, master switches or by removing starter keys.

9. Do not force a tool—Do not force a tool or attachment to do a job for which it was not

designed. Use the proper tool for the job.

10. Wear proper apparel—Avoid loose clothing, neckties, gloves or jewelry that could

become caught in moving parts. Wear protective headgear to keep long hairstyles away

from moving parts.

11. Use safety glasses—Also use a face or dust mask if a cutting operation is dusty.

12. Secure the work—Use clamps or a vise to hold work when practicable. It is safer

than using your hand and frees both hands to operate the tool.

13. Do not overreach—Keep your proper footing and balance at all times.

14. Maintain tools in top condition—Keep tools sharp and clean for best and safest

performance. Follow instructions for lubrication and changing

accessories.

15. Disconnect tools—Unplug tools before servicing and when changing accessories

such as blades, bits or cutters.

16. Avoid accidental starting—Make sure the switch is “OFF” before plugging in a

power cord.

17. Use only recommended accessories—Consult the owner’s manual. Use of improper

accessories may be hazardous.

18. Turn the spindle by hand BEFORE switching on the motor—This ensures that

the workpiece or chuck jaws will not hit the lathe bed, saddle or crossslide, and also

ensures that they clear the cutting tool.

[8:59 PM, 11/26/2019] Ibrahim: 19. Check that all holding, locking and driving devices are tightened—At the same

time, be careful not to over tighten these

[8:59 PM, 11/26/2019] Mughal: ok

[8:59 PM, 11/26/2019] Ibrahim: 20. Don’t use your lathe for grinding—The fine dust that results from the grinding

operation is extremely hard on bearings and other moving parts of your tool. For the same

reason, if the lathe or any other precision tool is kept near an operating grinder, it should

be kept covered when not in use.

21. Don’t let long, thin stock protrude from the back of the spindle—Long,

thin stock

that is unsupported and turned at high RPM can suddenly bend and whip around.

22. Wear your safety glasses—Foresight is better than NO SIGHT! The operation of

any power tool can result in foreign objects being thrown into the eyes, which can result

in severe eye damage. Always wear safety glasses or eye shields before commencing

power tool operation. We recommend a Wide Vision Safety Mask for use over spectacles

or standard safety glasses.

23. Checking/changing computer power supply voltage settings—Sherline attempts to

ship each CNC computer set to the proper voltage for the customer's country. Customers

outside the USA should check this setting to confirm it is correct before plugging in the

computer for the first time. If you need to change the voltage setting, there are two

switches. You must change both the 115V/230V power switch on the back of the

computer and the switch on the side of the driver board power supply inside the computer

case. For proper procedure, see Part I, System Components and Connections further on in

these instructions.

24. Static electricity can damage your computer—If the case must be

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p>opened, be sure</p> <p>you are properly grounded before touching any components inside your computer. A</p> <p>spark of static electricity can damage delicate circuits in some components in your</p> <p>computer. Either wear an approved static electricity grounding strap around your wrist or</p> <p>touch the case of the computer with one hand before touching any components with your</p> <p>other hand.</p> <p>25. Be sure you know what will happen BEFORE pushing the [START] button—</p> <p>Run your program in [BACKPLOT] mode before running the actual part to make sure it</p> <p>will run the path your are expecting. Make sure your machine is in the proper home</p> <p>position before starting the operation.</p> |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Module: 0714001060 De-commission robot at workplace

**Objective of the Module:** This Competency Standard identifies the competencies, for decommissioning and/or removal of equipment, is to ensure all equipment decommissioning/ removal and support systems decommissioning/removal are executed in a manner consistent with applicable codes, regulations and sound engineering practices. After passing this competency student will be able to ensure that equipment and support systems are decommissioned and removed in a manner that will allow lowest possible risk to employees, the facility, operations or maintenance activities. This competency standard deals with preparation of testing work bench, execute component testing for robotics and checking calibration status of the work bench. The learner will be able to perform component testing using the work bench and prepare a calibration report of test work bench after completing this competency level.

|           |             |        |         |       |           |        |
|-----------|-------------|--------|---------|-------|-----------|--------|
| Duration: | Total hours | 40 Hrs | Theory: | 4 Hrs | Practical | 36 Hrs |
|-----------|-------------|--------|---------|-------|-----------|--------|

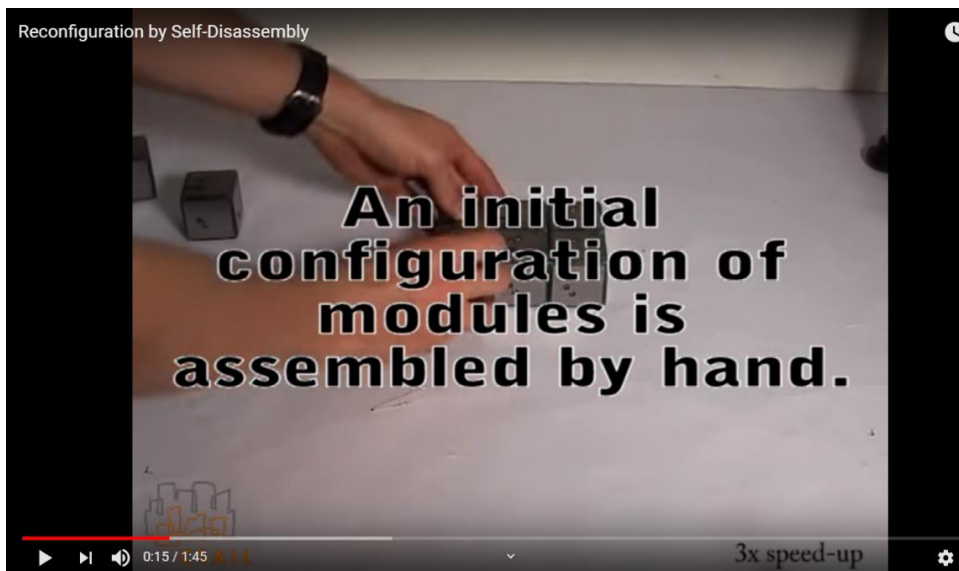
| Learning Unit                                           | Learning Outcomes                                                                                                                                                                                                                                                                | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Materials (Tools & Equipment) Required                                                                                                                                 |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Prepare for environment disassembling</b>       | <p>The trainee must be able to</p> <ul style="list-style-type: none"> <li>Identify disassembling requirements</li> <li>Perform pre-decommissioning checks such as Environment, health and safety (EHS).</li> <li>Select appropriate tools for disassembling of robot.</li> </ul> | <ul style="list-style-type: none"> <li>Describe disassembling requirements</li> <li>Describe checks that should be performed prior to decommissioning</li> <li>Describe tools that can be used for disassembly</li> <li>Demonstrate process of tools selection for disassembly</li> </ul> <p><b>Practical:</b><br/>Given a robotic unit that needs to be disassembled, perform all checks and select tools for disassembly.</p>                                   | <ul style="list-style-type: none"> <li>Sample of disposable, repairable and reusable components</li> <li>Mechanical Tool kit</li> <li>Basic electronics kit</li> </ul> |
| <b>LU2. Disassemble undeployed robot</b>                | <p>The trainee must be able to</p> <ul style="list-style-type: none"> <li>Identify order of disassembling</li> <li>Detach connections effectively</li> <li>Follow the standard operating procedure for disassembling of robot</li> </ul>                                         | <ul style="list-style-type: none"> <li>Describe how to determine the order of disassembly</li> <li>Describe different types of connections in a robotic unit</li> <li>Demonstrate how to detach connections</li> <li>Describe standard procedure for disassembling the robot</li> <li>Demonstrate disassembly of robotic unit</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>Given a robotic unit that required disassembly</li> </ul> |                                                                                                                                                                        |
| <b>LU3. Classify reusable and repairable components</b> | <p>The trainee must be able to</p> <ul style="list-style-type: none"> <li>Identify reusable and repairable components.</li> <li>Sort reusable and repairable components.</li> </ul>                                                                                              | <ul style="list-style-type: none"> <li>Describe procedure for determining the reusability of component</li> <li>Describe procedure for determining the repairability of a component</li> <li>Demonstrate identification of reusable/repairable components</li> <li>Describe sorting techniques for components</li> <li>Demonstrate sorting of components</li> <li>Describe labelling procedure for components</li> </ul>                                          |                                                                                                                                                                        |

|                                |                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                | <ul style="list-style-type: none"> <li>• Label reusable and repairable components.</li> </ul>                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Demonstrate labelling of components</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Given a number of components from a robotic unit, perform the following tasks:</li> <li>• Identify reusable components</li> <li>• Identify repairable components</li> <li>• Sort components according to reusable and repairable</li> <li>• Label components</li> </ul>                                                                                                                    |  |
| <b>LU4. Discard components</b> | <p><b>Dispose</b></p> <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Ensure that the component is not usable or repairable.</li> <li>• Identify EHS procedure for dispose of discarded components</li> <li>• Ensure proper disposal of discarded components</li> </ul> | <ul style="list-style-type: none"> <li>• Describe procedure for final testing of a component's reusability/repairability.</li> <li>• Describe EHS procedures for disposing robotic components</li> <li>• Describe procedure for disposal of components</li> <li>• Demonstrate disposal process for discarded components</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Given a number of discarded robotic components, perform final checks and dispose of the components properly following EHS guidelines</li> </ul> |  |



### Prepare environment for disassembling

<https://www.youtube.com/watch?v=F8X-Z6Sti1A>



### Disassemble undeployed robot

For disassembling a deployed robot.

<https://www.youtube.com/watch?v=1E017zUYMvw>

## Robotic Medical Syringe Assembly System with Six FANUC LR Mate Robots

Courtesy of  
**Farason Corporation**

0:08 / 2:49



### Robotic Medical Syringe Assembly System – Farason Corporation

<https://youtu.be/ykhYckjCfiU>

Classify reusable and repairable components

Its example is as follows:

#### AIRLINE MAINTENANCE

Maintenance programs are evolved and developed for each new type of aircraft based on previous experience with similar materials, engines, components, or structures. New materials or structures, for which experience is limited, are observed more frequently until a basic level of confidence is established. Time extensions to inspection intervals are based on observations made during routine service checks. A typical airline maintenance and service plan is outlined in [table 7-1](#). The objectives of an effective maintenance program are as follows (Edwards, 1994):

Ensure, through maintenance activity, that the inherent safety and reliability imparted to an aircraft by its design are sustained.

Provide opportunities to restore levels of safety and reliability when

Classify reusable and repairable components

deterioration occurs.

Obtain information for design modification when inherent reliability is not adequate.

Accomplish the above at the lowest possible cost.

#### Structural Maintenance

Any new aircraft program is based on assessing structural design information, fatigue and damage tolerance evaluations, service experience with similar aircraft structures, and pertinent test results. Generally, the maintenance task evaluates sources of structural deterioration including accidental damage, environmental deterioration, and fatigue damage; susceptibility of the structure to each source of deterioration; the consequences of structural deterioration to continuing airworthiness including effect on aircraft (e.g., loss of function and reduction of residual strength, multiple-site or multiple-element fatigue damage, the effect on aircraft flight or response characteristics caused by the interaction of structural damage or failure with systems or power plant items, or in-flight loss of structural items); and the applicability and effectiveness of various methods of detecting structural deterioration, taking into account inspection thresholds and repeat intervals.

#### Component Maintenance

The application of new materials will not cause undue maintenance difficulties or hardship for the airlines provided the aircraft designer is familiar with component experience. Airline experience indicates that hardware items wear out, but statistical old-age wear-out in complex mechanical, electrical, and avionic components is not a dominant pattern of failure. In fact, over 90 percent of generic part types show either random distribution of failure or gradually increasing probability of failure with age (Edwards, 1994).

The reliability of a part or component of aircraft hardware is only as

good as its inherent design (supported by adequate maintenance) allows it to be. Hence, it is generally accepted that (1) good maintenance allows parts to reach their potential reliability; (2) overmaintaining does not improve reliability, but does waste money; and (3) undermaintaining can degrade reliability. In general, fundamental design changes are required to correct inherent component reliability problems.

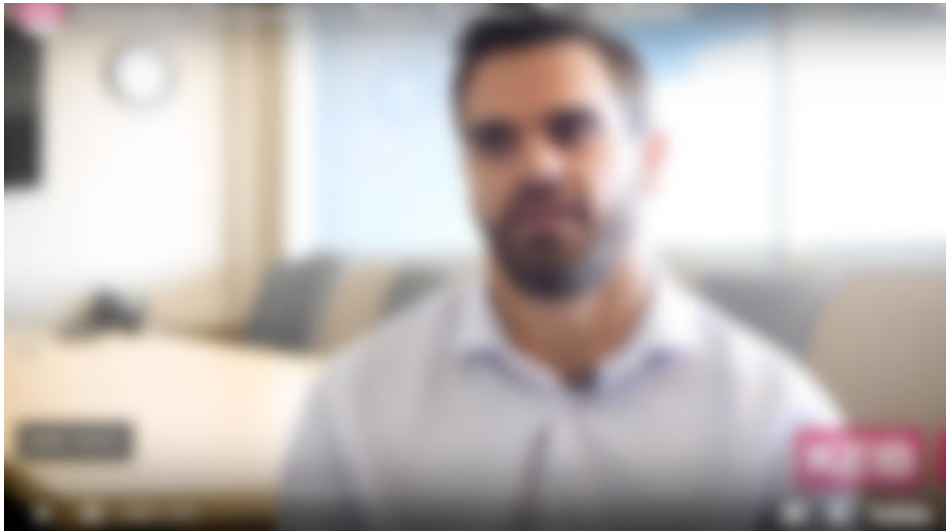
There are three approaches to preventative maintenance that have proven to be effective. The first method, hard time, involves removing a unit from service when it reaches a pre-ordained parameter value. The second method, functional check or inspection, involves monitoring a characteristic dimension or usage/operating parameter of a piece of hardware to determine if it is still suitable for continued operation, or if it should be removed to prevent an in-service failure. The third method, functional verification, requires performing an operational check of hardware function(s) to determine each function's availability if it is normally hidden from the scrutiny of the flight and operating crew.

There are many components for which measurement of deterioration, periodic removal for maintenance, and hidden function verification are not economically feasible or beneficial. Such parts require routine performance or reliability



### **Dispose discarded components**

<https://www.youtube.com/watch?v=2ckHP-U-mZQ>



### **Simplifying Communication**

<https://kebblog.com/automation-components-for-robotic-systems/>



<https://youtu.be/VPRkd3a7BIA>



**Robotic Assembly System for Electrical Wire Harnesses -  
Clear Automation**

<https://www.youtube.com/watch?v=IAgrrqTgWbQ&feature=youtu.be>

## Module: 0714001062 Perform functional testing of robotics

**Objective of the Module:** This module aims to provide the required knowledge and skill to perform functional testing of robotics unit. This includes the ability to identify and execute testing procedures, as well as to examine interfaces and equipment. Upon completion of this module the learner will be able to generate comprehensive test reports.

|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 60 | Theory: | 20 | Practical | 40 |
|-----------|-------------|----|---------|----|-----------|----|

| Learning Unit                                          | Learning Outcomes                                                                                                                                                                                                                                                                                                                          | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                    | Materials (Tools & Equipment) Required                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Identify desired functionality for testing</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>List all functions of robotic unit</li> <li>Isolate functions that require testing</li> <li>Prioritize functions for testing</li> <li>Organize related functions into groups</li> <li>Identify and create testing procedures required to test functionality</li> </ul> | <ul style="list-style-type: none"> <li>Describe about functional testing</li> <li>Describe all the basic functionalities of robotic Unit.</li> <li>Demonstrate all the basic functionalities of robotic Unit.</li> <li>Describe the procedure for functional testing.</li> <li>Demonstration of procedure for functional testing.</li> <li>Demonstrate prioritization of function testing</li> </ul> | <ul style="list-style-type: none"> <li>Multi-meter</li> <li>Oscilloscope</li> <li>Computer systems</li> <li>Professional Electronic toolkit</li> <li>Professional Mechanical toolkit</li> <li>RPM meter</li> <li>Temperature meter</li> <li>Torque meter</li> <li>Barometer</li> <li>Robotic system</li> <li>Controller</li> </ul> |
|                                                        |                                                                                                                                                                                                                                                                                                                                            | <b>Practical</b> <ul style="list-style-type: none"> <li>Create and prioritize procedure required for functional testing</li> </ul>                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                    |

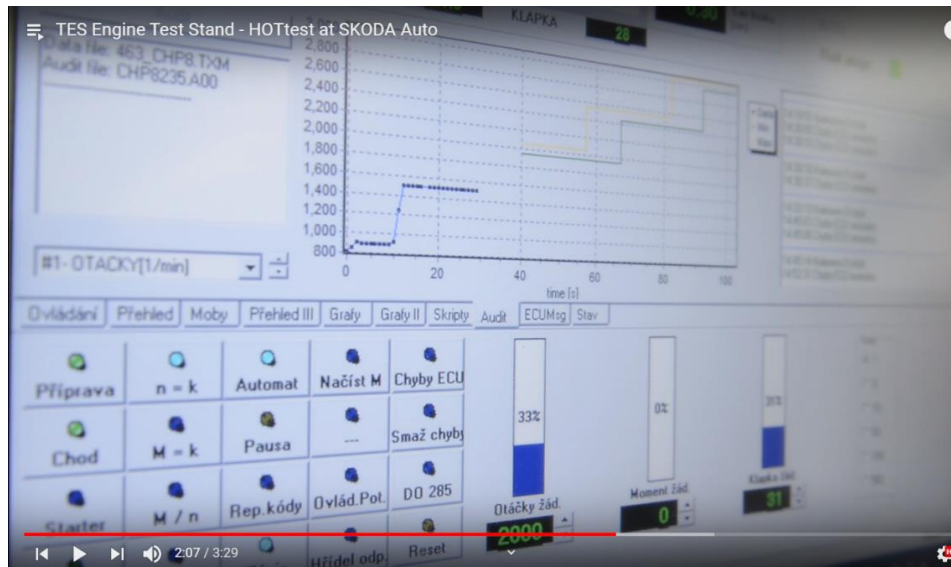
|                                                |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                          |           |
|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>LU2. Execute relevant testing procedure</b> | <ul style="list-style-type: none"> <li>• Prepare robotic unit for testing</li> <li>• Identify testing procedure to be executed</li> <li>• Select testing equipment to be used during tests</li> <li>• Indicate required results to be achieved</li> <li>• Execute testing steps in order</li> <li>• Compile results of all tests</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the testing procedure for execution</li> <li>• Describe all the testing tools used during test</li> <li>• Demonstrate all the testing tools used during test</li> <li>• Describe all the steps of testing while execution.</li> <li>• Demonstrate all the steps of testing while execution.</li> </ul> | As Unit-1 |
|                                                |                                                                                                                                                                                                                                                                                                                                             | <b>Practical</b> <ul style="list-style-type: none"> <li>• Create Testing Procedure for given task</li> <li>• Execute testing step by step in order to perform all the functionality.</li> <li>• Compile Results of all the functionality testing</li> </ul>                                                                                              |           |

|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>LU3. Examine detailed functionality of interfaces</b> | <ul style="list-style-type: none"> <li>• List all interfaces</li> <li>• Identify interfaces which can be examined</li> <li>• Ensure firmware gave proper instruction to the hardware</li> <li>• Organize interface in order of examination</li> <li>• Identify acceptable functionality of interface</li> <li>• Utilize the specific interface</li> <li>• Examine functioning of the specific interface</li> <li>• Analyse examination results</li> <li>• Compile examination results</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the functionality of interfaces</li> <li>• Demonstrate how to examine the interface</li> <li>• Describe acceptable and non-acceptable functionality of interface</li> <li>• Explain Firmware</li> <li>• Describe the functionality of firmware and related issues.</li> <li>• Demonstrate how to examine functioning of the specific interface</li> <li>• Describe the analysis of results</li> </ul> |  |
|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Practice:</b> <ul style="list-style-type: none"> <li>• Examine function of interface and analyze examination results.</li> </ul>                                                                                                                                                                                                                                                                                                                     |  |

|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>LU4. Examine detailed functionality of equipment</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• List all equipment who's functionality requires examination</li> <li>• List functionality of equipment's to be examined</li> <li>• Identify tools required for examination</li> <li>• Arrange tools required for examination</li> <li>• Identify acceptable functionality of equipment</li> <li>• Examine equipment using specific tools</li> <li>• Analyze examination results</li> <li>• Compile examination results</li> </ul> | <ul style="list-style-type: none"> <li>• Describe how to examine equipment and their functionality</li> <li>• Describe tools and arrange tools for examination</li> <li>• Describe acceptable and non-acceptable functionality of equipment</li> <li>• Demonstrate acceptable and non-acceptable functionality of equipment</li> <li>• Describe the analysis of results</li> <li>• Demonstrate equipment using specific tools</li> </ul> <p><b>Practical:</b></p> <ul style="list-style-type: none"> <li>• Examine function of equipment and analyze examination results.</li> </ul> |  |
| <b>LU5. Generate test report</b>                        | <ul style="list-style-type: none"> <li>• List all tests for which report is required</li> <li>• Identify result outcomes that are required to be reported</li> <li>• Prepare optimal template for test report</li> <li>• Compose test report based on template</li> </ul>                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• Describe Identification of result outcomes.</li> <li>• Describe template for test report</li> <li>• Describe the composition of test report based on template</li> <li>• Describe the quality of test report</li> <li>• Demonstrate how to assure quality of test report</li> </ul>                                                                                                                                                                                                                                                         |  |

|  |                                                                                                                          |                                                                                                                                                                                    |  |
|--|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <ul style="list-style-type: none"> <li>Assure quality of test report</li> <li>Identify distribution of report</li> </ul> | <b>Practical</b> <ul style="list-style-type: none"> <li>List all tests for reports</li> <li>Prepare template for report and compose test report with quality assurance.</li> </ul> |  |
|--|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Example and Illustration

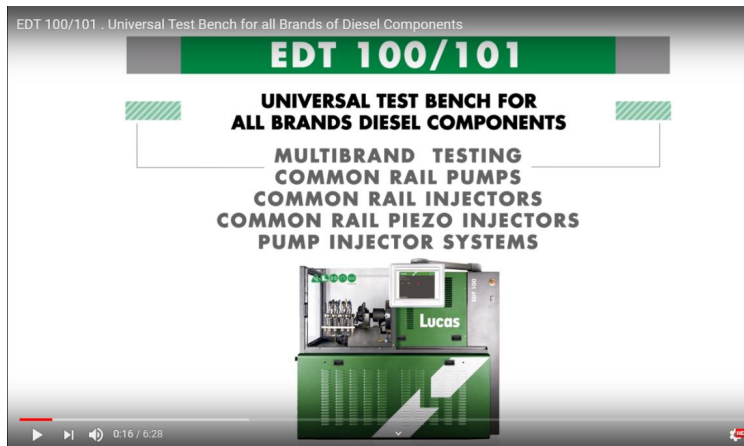


Identify desired functionality for testing

<https://www.youtube.com/watch?v=IftyD7hnOqs>

## Execute relevant testing procedure

<https://www.youtube.com/watch?v=6oyPcdtv7gc>



## Examine detailed functionality of equipment

<https://www.financewalk.com/industry-analysis/>

## Examine detailed functionality of equipment

<https://www.financewalk.com/industry>

The following is just for an example to visit the web site, Trainer can provide best example and illustration rather than this at run time as per the task given to the trainee

### How to Do Industry Analysis, Examples, Steps, Porter Model.....

- The Need for Industry Analysis
- How to do Industry Analysis?
- Review available reports
- Approach the correct industry
- Demand & supply scenario
- Competitive scenario
- Recent developments
- Focus on industry dynamicsEndnote



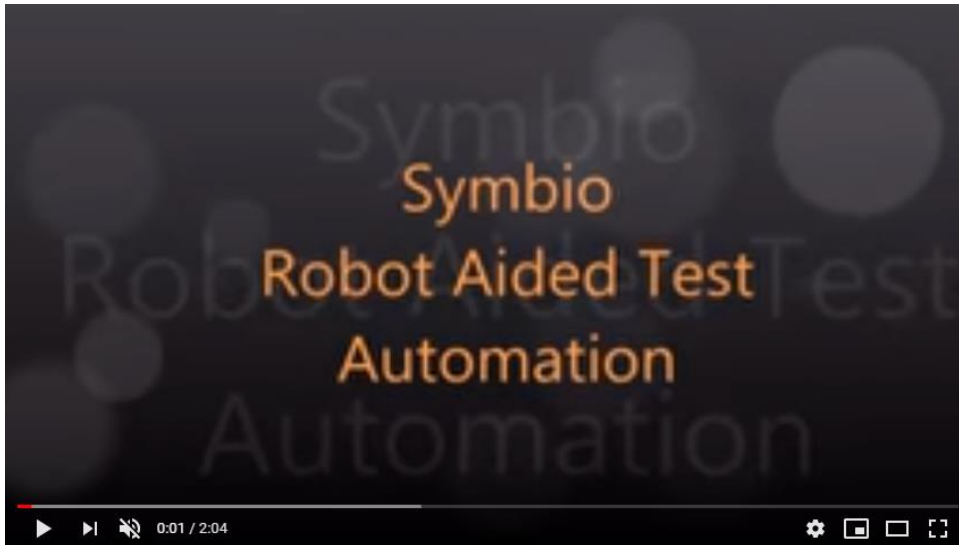
## GTAC 2015: Robot Assisted Test Automation

<https://www.youtube.com/watch?v=oQRrk7S9sUE&feature=youtu.be>



## Robotic PCB Loader-Functional Test

[https://youtu.be/qQiZSBk\\_ruA](https://youtu.be/qQiZSBk_ruA)



Symbio RATA (Robot Aided Test Automation) Demo

[https://youtu.be/n\\_915xMRGAo](https://youtu.be/n_915xMRGAo)

Sampling , Inspection & Testing procedures

| Lot Size         | Sample Size | Acceptance No. | Rejection No. |
|------------------|-------------|----------------|---------------|
| 2 to 8           | Max. 5      | 0              | 1             |
| 9 to 15          | 5           | 0              | 1             |
| 16 to 25         | 5           | 0              | 1             |
| 26 to 50         | 5           | 0              | 1             |
| 51 to 90         | 20          | 1              | 2             |
| 91 to 150        | 20          | 1              | 2             |
| 151 to 280       | 32          | 2              | 3             |
| 281 to 500       | 50          | 3              | 4             |
| 501 to 1200      | 80          | 5              | 6             |
| 1201 to 3200     | 125         | 7              | 8             |
| 3201 to 10000    | 200         | 10             | 11            |
| 10001 to 35000   | 315         | 14             | 15            |
| 35000 to 150000  | 500         | 21             | 22            |
| 150001 to 500000 | 500         | 21             | 22            |
| 500001 and over  | 500         | 21             | 22            |

Generate test report

<https://www.youtube.com/watch?v=80wCEQ55uf0>

## Module: 0714001063 Commission robot at workplace

**Objective of the Module:** This competency level deals with preparing environment, unboxing, commissioning and initial testing of the robotic system. The learner will be able to commission a robotic system under supervision after completing this competency level.

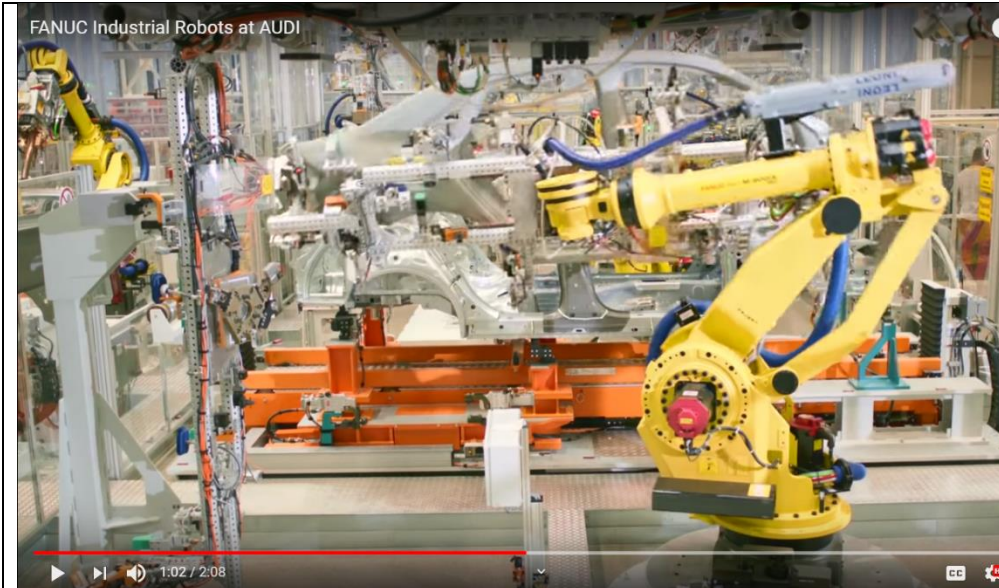
|           |             |        |         |        |           |        |
|-----------|-------------|--------|---------|--------|-----------|--------|
| Duration: | Total hours | 60 Hrs | Theory: | 12 Hrs | Practical | 48 Hrs |
|-----------|-------------|--------|---------|--------|-----------|--------|

| Learning Unit                                              | Learning Outcomes                                                                                                                                                                                                                                                                                  | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Materials (Tools & Equipment) Required                                                                                                                          |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Prepare environment for commissioning of robot</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Specify environmental conditions for commissioning of robot.</li> <li>Prepare suitable environment for commissioning of robot.</li> <li>Arrange tools and equipment required for the commissioning of robot.</li> </ul> | <ul style="list-style-type: none"> <li>Describe environmental requirements for commissioning of robot</li> <li>Demonstrate preparation of environment for commissioning of robot</li> <li>Describe tools and equipment required for commission of robot</li> <li>Demonstrate arrangement of tools for commissioning of robot</li> <li>Practical</li> <li>Given a robot from a specific robotic platform, prepare the environment and arrange tools and equipment for commissioning of robot</li> </ul> | <ul style="list-style-type: none"> <li>Robotic system</li> <li>Electronic tool kit</li> <li>Mechanical tool kit</li> <li>Computers</li> <li>Printers</li> </ul> |
| <b>LU2. Unbox robotic system</b>                           | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify instructions manual for unboxing of robotic system.</li> <li>Arrange tools and equipment required for unboxing robotic</li> </ul>                                                                              | <ul style="list-style-type: none"> <li>Describe various types of instruction manuals</li> <li>Describe various tools and equipment for unboxing robotic system</li> <li>Describe how to comprehend and follow instructions given in manual</li> <li>Demonstrate usage of instructional manual</li> <li>Demonstrate unboxing of robotic system</li> <li>Practical</li> </ul>                                                                                                                            | As unit-1                                                                                                                                                       |

|                                                                   |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                   | system <ul style="list-style-type: none"> <li>Follow instructions provided in manual for unboxing of robotic system</li> </ul>                                                                                                                                              | <ul style="list-style-type: none"> <li>Given a robotic system, perform proper unboxing by following given instruction manual</li> </ul>                                                                                                                                                                                                                                                                                                             |           |
| <b>LU3. Comprehend commissioning and operational instructions</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>Identify commissioning and operational manuals.</li> <li>Follow commissioning and operational instructions from manual</li> <li>Assist supervisor in commissioning steps provided in manual.</li> </ul> | <ul style="list-style-type: none"> <li>Describe various types of commissioning and operational manuals</li> <li>Describe how to comprehend and follow instructions given in manuals</li> <li>Demonstrate usage of instructional manual</li> <li>Demonstrate unboxing of robotic system</li> </ul> Practical <ul style="list-style-type: none"> <li>Given a robotic system, perform proper unboxing by following given instruction manual</li> </ul> | As unit-1 |
| <b>LU4. Perform basic assembly</b>                                | The trainee must be able to: <ul style="list-style-type: none"> <li>Identify required basic assembly</li> <li>Prioritize basic assembly based on requirements</li> <li>Follow instruction manual to perform basic assembly</li> </ul>                                       | <ul style="list-style-type: none"> <li>Describe basic assembly required for commissioning of robot</li> <li>Describe procedure for determining the order of assembly</li> <li>Describe how to comprehend assembly instructions from manual</li> <li>Demonstrate basic assembly of robot</li> <li>Practical</li> <li>Given a robot that requires basic assembly, perform the said assembly as per instructions given in manual</li> </ul>            |           |
| <b>LU5. Perform initial testing of commissioned robot</b>         | <ul style="list-style-type: none"> <li>Perform initial tests of commissioned robot.</li> <li>Follow steps for initial testing of robot.</li> <li>Prepare initial testing report</li> </ul>                                                                                  | <ul style="list-style-type: none"> <li>Describe different initial tests for robot</li> <li>Describe all steps required for perform initial tests</li> <li>Describe reporting formats for reporting test results</li> <li>Demonstrate initial testing of robot</li> <li>Demonstrate test reporting</li> <li>Practical</li> </ul>                                                                                                                     |           |

- |  |  |                                                                                                                                                            |  |
|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  | <ul style="list-style-type: none"><li>• Given a newly commissioned robot, perform initial testing as per requirements and generate a test report</li></ul> |  |
|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Example and Illustration



**Prepare environment for commissioning of robot**

<https://www.youtube.com/watch?v=rbki4HR41-4>

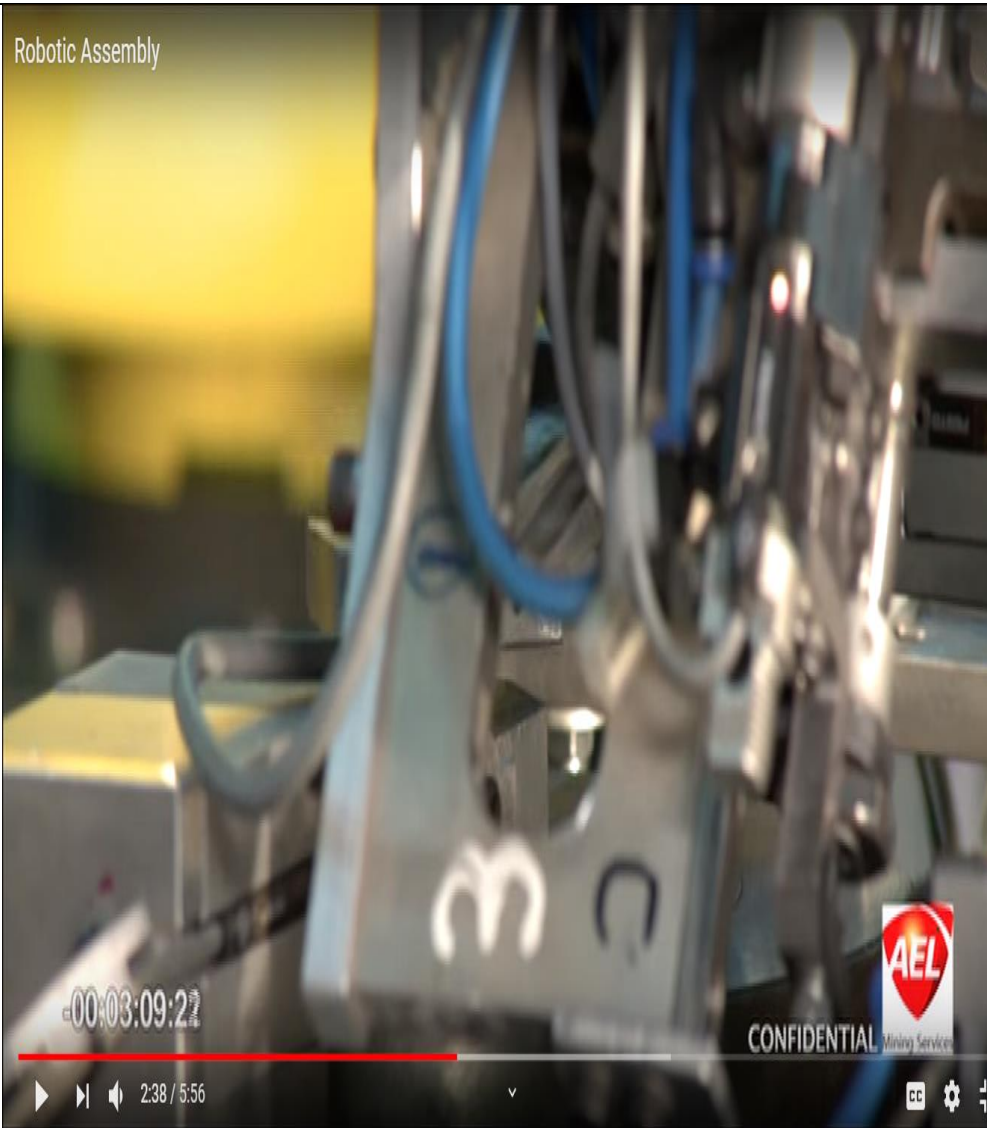
Unboxing Jibo : The Adorable Social Robot of the Future!



**Unbox robotic system**

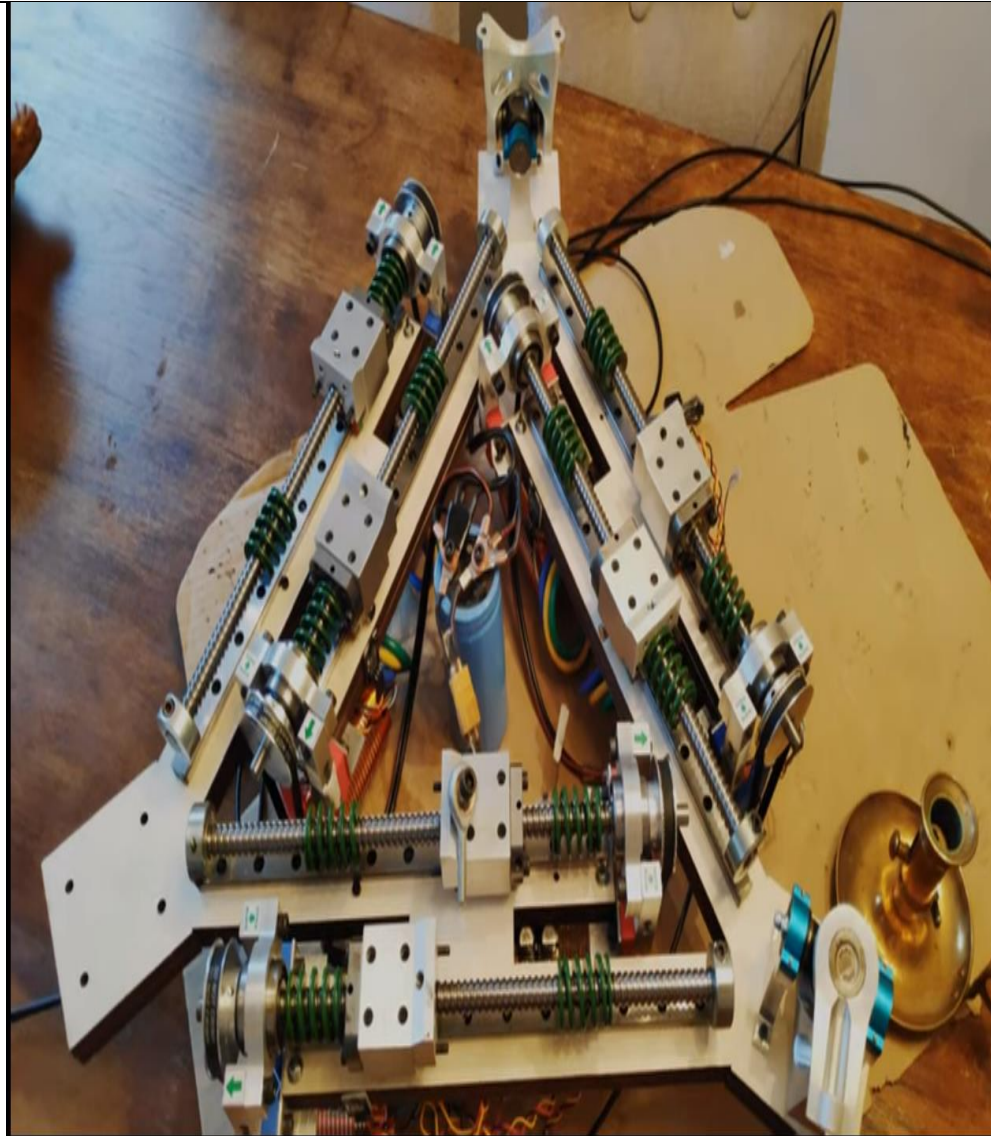
<https://www.youtube.com/watch?v=37dAP2D0rqc>

Robotic Assembly



**Perform basic assembly**

<https://www.youtube.com/watch?v=DsJ1EIoMhIq>



**Perform initial testing of commissioned robot**

<https://www.youtube.com/watch?v=8btqQDsM1Tk>

## Module: 0714001064 Deploy robot at workplace

**Objective of the Module:** This competency level is about preparing the deployment site along with transportation, installation and initial testing of the robotic system. The learner will be able to transport and deploy the robotic system at suitable site.

|           |             |        |         |        |           |        |
|-----------|-------------|--------|---------|--------|-----------|--------|
| Duration: | Total hours | 60 Hrs | Theory: | 12 Hrs | Practical | 48 Hrs |
|-----------|-------------|--------|---------|--------|-----------|--------|

| Learning Unit                                                      | Learning Outcomes                                                                                                                                                                                                                                                              | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Materials (Tools & Equipment) Required                                                                                                                                                        |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Prepare environment for deployment of robot</b>            | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Specify environmental parameters for deployment of robot.</li> <li>Identify suitable environment for deployment of robot.</li> <li>Prepare suitable environment for deployment of robot.</li> </ul> | <ul style="list-style-type: none"> <li>Describe environmental parameters required for deployment of robot</li> <li>Describe procedure for determining suitability of environment for deployment</li> <li>Demonstrate how to prepare the environment for deployment of robot</li> </ul> <p>Practical</p> <ul style="list-style-type: none"> <li>Given a robot, determine the environmental parameters required for deployment and prepare the environment for deployment</li> </ul> | <ul style="list-style-type: none"> <li>Robotic system</li> <li>Electronic tool kit</li> <li>Mechanical tool kit</li> <li>Computers</li> <li>Printers</li> <li>Transportation means</li> </ul> |
| <b>LU2. Transport robot and relevant system to deployment site</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify transportation means for the robotic system.</li> <li>Arrange transportation of the robot to the deployment site.</li> <li>Ensure safe transportation of</li> </ul>                        | <ul style="list-style-type: none"> <li>Describe transportation procedures for robotic system</li> <li>Describe planning of transportation</li> <li>Demonstrate transportation of robotic system to deployment site</li> <li>Describe safety precautions required during transportation</li> </ul> <p>Practical</p> <ul style="list-style-type: none"> <li>Given a robotic system, transport the robotic system to the deployment site safely</li> </ul>                            | As unit-1                                                                                                                                                                                     |

|                                                       |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                       | the robotic system.                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |           |
| <b>CU3. Install robot at site</b>                     | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify installation manuals.</li> <li>• Arrange tools and equipment required for the deployment of robot.</li> <li>• Follow instructions provided in manuals to install the robot at site.</li> </ul> | <ul style="list-style-type: none"> <li>• Describe various installation manuals</li> <li>• Describe various tools and equipment available for deployment for robot</li> <li>• Describe procedure for installing the robot at deployment site</li> <li>• Demonstrate installation of robot at deployment site as per instructions given in manual</li> </ul> <p>Practical</p> <ul style="list-style-type: none"> <li>• Given a robotic system, perform installation of the robot at the deployment site as per instructions</li> </ul> | As unit-1 |
| <b>LU4. Execute initial testing of deployed robot</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Comprehend initial tests of deployed robot.</li> <li>• Follow steps for initial testing of deployed robot.</li> <li>• Prepare initial testing report.</li> </ul>                                        | <ul style="list-style-type: none"> <li>• Describe initial testing of robotic system after installation</li> <li>• Describe how to prepare testing report</li> <li>• Demonstrate testing of robotic system after installation</li> </ul> <p>Practical</p> <ul style="list-style-type: none"> <li>• Given a newly installed robotic system, perform post installation initial tests and generate test report</li> </ul>                                                                                                                | As unit-1 |

## Examples and Illustration



### Deploy the Robot to Orchestrator|UiPath Deployment Process Part - 3 | UiPath Tutorial For Beginners

<https://www.youtube.com/watch?v=N3vFzaSG5gM>



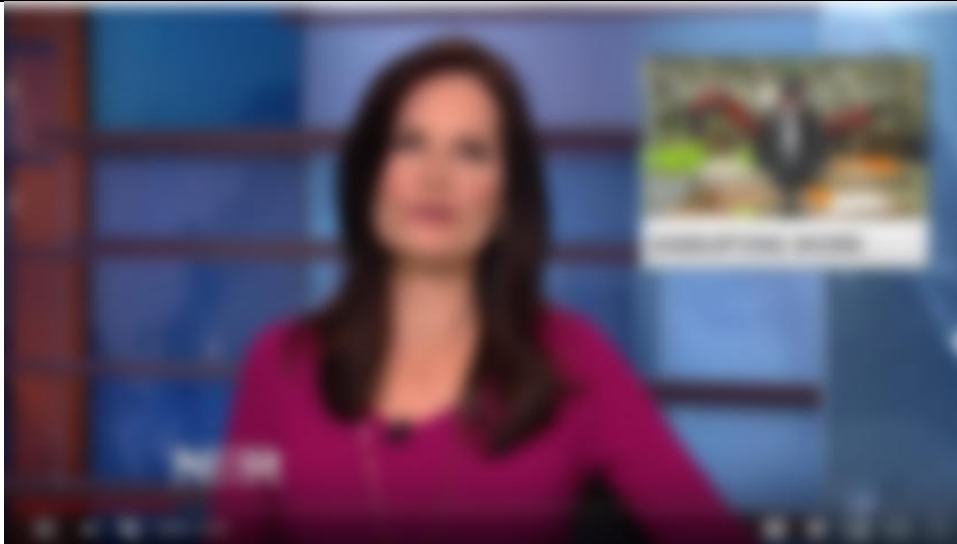
### KPA deploy an underwater robot to help locate the plunged car

<https://www.youtube.com/watch?v=p7AIMFcTOBQ>



Robots for the workplace

<https://www.youtube.com/watch?v=gp3dGUsyXS4>



Sharing a workplace with robot

<https://www.youtube.com/watch?v=AMWUUQ-1tMg>

## Module: 0714001065 Monitor Operations of robot at workplace

**Objective of the Module:** This module covers the learning units required to monitor operation of robot at workplace. The trainee will be able to identify desired outcome of robot operation, identify errors, perform corrective measure, prepare operation report and maintain historic log..

|           |             |    |         |    |           |    |
|-----------|-------------|----|---------|----|-----------|----|
| Duration: | Total hours | 40 | Theory: | 10 | Practical | 30 |
|-----------|-------------|----|---------|----|-----------|----|

| Learning Unit                                             | Learning Outcomes                                                                                                                                                                                                                                                                                      | Learning Elements                                                                                                                                                                             | Materials (Tools & Equipment) Required                                                                                                                                                       |
|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Identify desired outcomes of robot operations</b> | The trainee must be able to: <ul style="list-style-type: none"><li>• List all robot operation</li><li>• Select robot operation for which outcomes have to be identified</li><li>• List all possible outcomes of specified robot operation</li><li>• Recognize important parameters to assess</li></ul> | <ul style="list-style-type: none"><li>• Explain all robot's operations and its selection for particular outcome</li><li>• Outline all possible outcomes and its assessment criteria</li></ul> | <ul style="list-style-type: none"><li>• Robotic system</li><li>• Electronic tool kit</li><li>• Mechanical tool kit</li><li>• Computers</li><li>• Printers</li><li>• Transportation</li></ul> |

|                                                              |                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                              |       |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
|                                                              | <p>outcomes of robot operation.</p> <ul style="list-style-type: none"> <li>Identify desired outcomes</li> </ul>                                                                                                                             | <p><b>Practical-1:</b><br/>Enlist all possible operation of robot with their possible outcomes.<br/><b>Practical-2</b><br/>Enlist criteria for assessing an outcome of robot operation</p>                                                                                                                                                                                   | means |
| <b>LU2. Examine outcomes against established thresh hold</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>List established thresh holds for outcome</li> <li>Assess outcomes of the robotic operation</li> <li>Compare outcome against established thresh holds</li> </ul> | <ul style="list-style-type: none"> <li>Describe thresholds and their assessment criteria's</li> <li>Demonstrate any outcome of robotic operation against established threshold.</li> </ul> <p><b>Practical-1:</b><br/>Identify any particular threshold then compare it according to the established threshold.</p>                                                          |       |
| <b>LU3. Identify short comings in outcomes</b>               | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Examine errors in outcomes</li> <li>Apply corrective measure to eliminate errors</li> <li>Prepare operation report</li> </ul>                                    | <ul style="list-style-type: none"> <li>Explain different types of errors in outcome and their respective corrective measures</li> <li>Demonstrate types of errors in outcome and their respective corrective measures</li> </ul> <p><b>Practical-1:</b><br/>Analyze and prepare report on the outcome of any robot operation by identifying errors and eliminating them.</p> |       |

|                                    |                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                           |  |
|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                    |                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>•</li> </ul>                                                                                                                                                                                                                                                                                                                                                       |  |
| <b>LU4.Maintain historical log</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify log parameter</li> <li>• Prepare routine log</li> <li>• Create sense of continuity and consistency while maintaining logs</li> <li>• Keep the log factual and detailed</li> </ul> | <ul style="list-style-type: none"> <li>• Explain the following:               <ul style="list-style-type: none"> <li>○ Log parameters</li> <li>○ Routine log preparation</li> <li>○ continuity and consistency in logs</li> <li>○ Details required in maintaining log</li> </ul> </li> <li>• Demonstrate report on existing Historical log which includes identification of log parameter etc.</li> </ul> |  |
|                                    |                                                                                                                                                                                                                                                                         | <p><b>Practical-1:</b></p> <p>Prepare routine log report, add all required parameters and information. Make sure logs have sense of continuity, consistency and contain factual details.</p>                                                                                                                                                                                                              |  |

## Examples and Illustrations

## Why Robotics

- Total hip and knee replacements currently have a 90-95% success rate
- What about the other 10%?
- Patient satisfaction 80-85%

Medical City

0:07 / 13:38

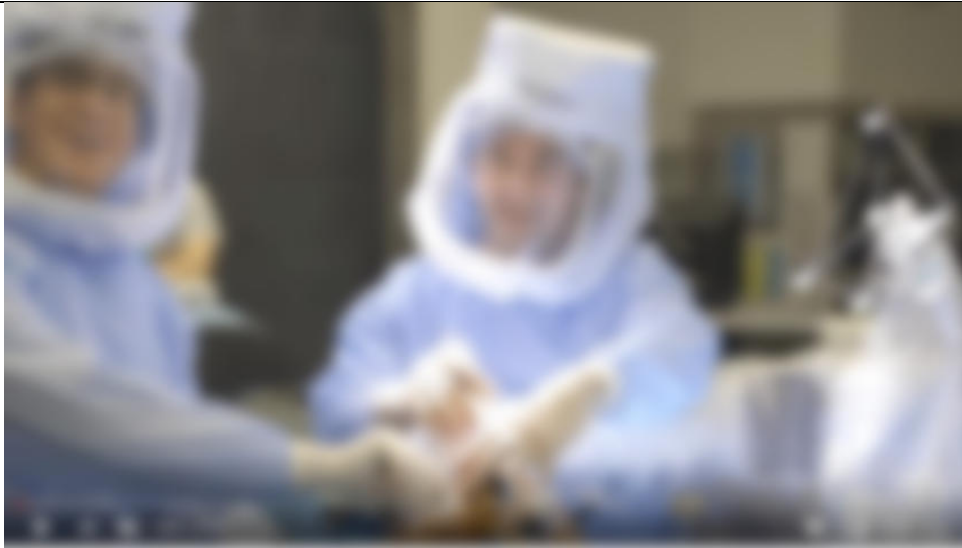
Outcomes & Benefits of Robotic Joint Replacement Surgery with Dr. Charles Rutherford

<https://www.youtube.com/watch?v=F0klfOzNVhY>



Japan's robot revolution - BBC Click

<https://www.youtube.com/watch?v=zKhm89FWOy8>



[https://www.youtube.com/watch?v=mF3fbW\\_ZVp0](https://www.youtube.com/watch?v=mF3fbW_ZVp0)

## Module: 0714001066 Perform assembling of equipment / components

**Objective of the Module:** The objective of this exercise is to make a functional robot by performing assembly of equipment/ components. The trainee will be able to understand the robot architecture and will be able to assemble various types of robots.

| Duration:                       | Total hours                                                                                                                                                                                                                                              | 40 Hrs                                                                                                                                                                                                                                                         | Theory:                                                                                                                   | 8 | Practical | 32 |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|---|-----------|----|
| Learning Unit                   | Learning Outcomes                                                                                                                                                                                                                                        | Learning Elements                                                                                                                                                                                                                                              | Materials (Tools & Equipment) Required                                                                                    |   |           |    |
| LU1. Comprehend assembly manual | The trainee must be able to: <ul style="list-style-type: none"><li>Acquire list of assembly manuals</li><li>Select relevant assembly/ installation manuals</li><li>Read instruction manual thoroughly</li><li>Mark relevant steps for assembly</li></ul> | <ul style="list-style-type: none"><li>Define assembly manuals.</li><li>Explain purpose of assembly manuals.</li><li>Describe how we can choose correct assembly manuals.</li><li>Explain how to collect all assembly manuals for assembling a Robot.</li></ul> | <ul style="list-style-type: none"><li>Mechanical tools kit</li><li>Electrical tool kit</li><li>Robotic tool kit</li></ul> |   |           |    |
|                                 |                                                                                                                                                                                                                                                          | <b>Practical:</b><br>Select any model of Robot which is available and collect all of its assembling manuals and then write the relevant steps for assembly in your report.                                                                                     |                                                                                                                           |   |           |    |
| LU2. Prepare assembly plan      | The trainee must be able to: <ul style="list-style-type: none"><li>List the operation procedure for assembly</li><li>Organize the assembly plan</li></ul>                                                                                                | <ul style="list-style-type: none"><li>Describe each operational procedure for assembly.</li><li>Explain how to organize any plan for assembly.</li><li>Explain the purpose of each tool used in assemble a Robot.</li></ul>                                    | As Unit-1                                                                                                                 |   |           |    |

|                                         |                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                           |  |
|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                                         | <ul style="list-style-type: none"> <li>• Make list of required items</li> <li>• Identify necessary tools required for assembly</li> <li>• Devise an alternate plan if necessary</li> </ul>                                                                                          | <b>Practical:</b><br>Make a list of operational procedures for assemble a robot and collect all tools required for assembling.                                                                                                                                                                                                            |  |
| <b>LU3. Perform assembly as per SOP</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Ensure safety standards</li> <li>• Prepare a working environment for assembly</li> <li>• List all steps as per SOP.</li> <li>• Prioritize the assembly steps</li> <li>• Follow the assembly steps.</li> </ul> | <ul style="list-style-type: none"> <li>• Define health and safety standards.</li> <li>• Use proper working gear during working.</li> <li>• Describe working environment.</li> <li>• Ensure use of proper lifting machinery for Robot handling.</li> <li>• Define all SOP for assembling.</li> <li>• Define all assembly steps.</li> </ul> |  |
|                                         |                                                                                                                                                                                                                                                                                     | <b>Practical:</b><br>Make a report with pictures which shows all the steps of assembling a robot with safety measures.                                                                                                                                                                                                                    |  |

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                 |           |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>LU4. Verify assembly as per standards</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• List all assemblies performed</li> <li>• Select assemblies that require verification</li> <li>• Identify verification procedure for selected assembly</li> <li>• Match the assembly with the drawing</li> <li>• Inspect joint/links coupling of the robot</li> <li>• Verify the wire connections</li> <li>• Compare assembly with the manual</li> <li>• Generate verification report</li> </ul> | <ul style="list-style-type: none"> <li>• Elaborate verification procedure.</li> <li>• Describe the assembly which needs to be verified.</li> <li>• Explain the drawing of each assembly.</li> <li>• Describe procedure to inspect the joints coupling.</li> <li>• Describe all power up connections.</li> </ul> | As unit-1 |
|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Practical:</b><br>Assemble the complete robot and make a report with pictures to elaborate all wiring connections, procedure of assembly verification and inspection of joint coupling.                                                                                                                      |           |

## Example and Illustrations



Comprehend assembly manual of robot

<https://www.youtube.com/watch?v=I1MOxx0Q1D0>



Electronics Assembly, Machine Tending & Material Handling -  
Kawasaki duAro robot

<https://www.youtube.com/watch?v=VPRkd3a7BIA>



Robotic Assembly System for Electrical Wire Harnesses - Clear Automation

<https://www.youtube.com/watch?v=lAqrrqTgWbQ>



Prepare assembly plan for robot

<https://www.youtube.com/watch?v=uW8YVcBjPGU>

## How to Build an Arduino Robot by Thomas Messerschmidt

0:04 / 9:49

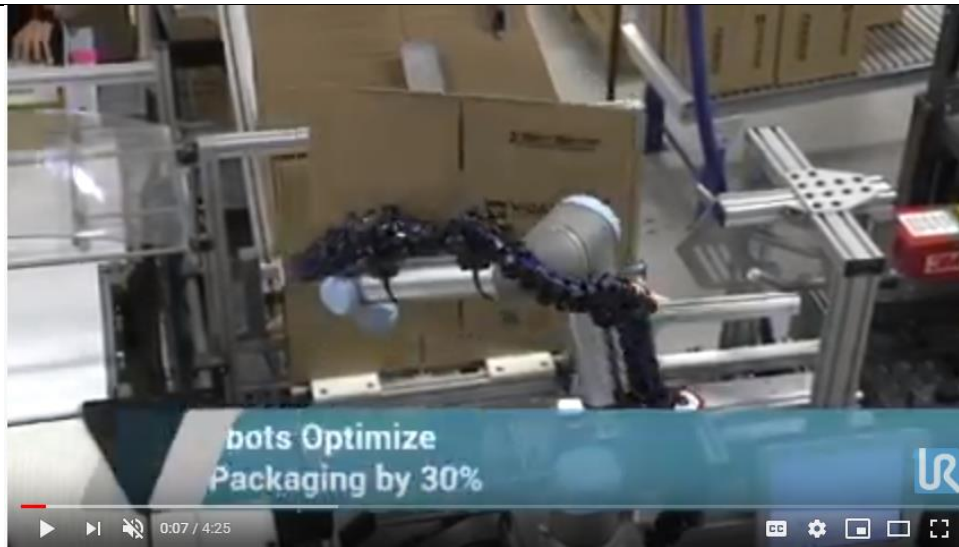
How to assemble the 2WD Smart Robot Car Chassis Kit for Arduino

<https://www.youtube.com/watch?v=H78t6dnSoG0>



Fast Extreme Automatic Car Manufacturing Factory, Modern Mercedes Benz Assembly Technology

<https://www.youtube.com/watch?v=5pn8qAKL0V4>



## Cobots Take Over Undesirable Tasks, Optimize Assembly and Packaging by 30%

<https://www.youtube.com/watch?v=8e76BjH9ez4>

## Module: 0714001072 Perform maintenance of robotics

**Objective of the Module:** This Competency Standard identifies the required skills and knowledge to adopt for maintenance of robotic systems. After completing this competency trainee will be able to develop maintenance schedule, perform maintenance, supervise and ensure maintenance as per standard procedures. Trainee will also be able to perform post maintenance test to ensure proper working.

|           |                |         |       |           |       |
|-----------|----------------|---------|-------|-----------|-------|
| Duration: | Total hours 50 | Theory: | 10hrs | Practical | 40hrs |
|-----------|----------------|---------|-------|-----------|-------|

| Learning Unit                           | Learning Outcomes                                                                                                                                                                                                                                                                                                                    | Learning Elements                                                                                                                                                                                                                                                                                                                                                                                             | Materials (Tools & Equipment) Required                                                                                                                  |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1.Develop maintenance schedule</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify equipment that require maintenance</li> <li>Determine frequency of maintenance required</li> <li>Prioritize required maintenance</li> <li>Create database on equipment to be inspected and maintained</li> <li>Draft maintenance plan</li> </ul> | <ul style="list-style-type: none"> <li>Describe the importance of maintenance schedules</li> <li>Describe preventive maintenance to reduce downtime</li> <li>Describe maintenance logs, failure histories or maintenance records</li> <li>Demonstrate maintenance schedule</li> <li>Demonstrate prioritizing critical equipment schedule for maintenance</li> <li>Demonstrate Maintenance planning</li> </ul> | <ul style="list-style-type: none"> <li>Mechanical tools kit</li> <li>Electrical tool kit</li> <li>Robotic tool kit</li> <li>Robotic Platform</li> </ul> |

|                                                                           |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |
|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                     | <b>Practical</b> <ul style="list-style-type: none"> <li>• Develop maintenance schedule</li> <li>• Develop record of equipment maintained and inspected</li> </ul>                                                                                                                                                                                                                                                                                             |           |
| <b>LU2. Perform maintenance as per procedure standards and guidelines</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify tool and equipment required for maintenance</li> <li>• Arrange tool and equipment required to perform maintenance at workplace</li> <li>• Read instruction manuals thoroughly to perform maintenance</li> <li>• Follow steps provided in standard procedure and guideline</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the list of tool/ equipment required for maintenance and their arrangement</li> <li>• Describe instruction manuals for maintenance</li> <li>• Describe key steps involved in maintenance procedure</li> <li>• Demonstrate tool/ equipment required for maintenance</li> <li>• Demonstrate instruction manuals for maintenance</li> <li>• Demonstrate key steps involved in maintenance procedure</li> </ul> | As Unit-1 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                     | <b>Practical</b> <ul style="list-style-type: none"> <li>• Perform key maintenance steps using instruction manuals and appropriate tools and equipment</li> </ul>                                                                                                                                                                                                                                                                                              |           |
| <b>LU3. Supervise maintenance staff</b>                                   | The trainee must be able to: <ul style="list-style-type: none"> <li>• Formulate list of duties as per staff skill set</li> <li>• Assign duties to staff</li> <li>• Ensure individual and teamwork.</li> <li>• Ensure maintenance carried out as per standard procedure and guidelines.</li> </ul>                                                                   | <ul style="list-style-type: none"> <li>• Describe list of duties for staff skill set</li> <li>• Describe the importance of individual and teamwork</li> <li>• Describe standard maintenance procedures and guidelines.</li> <li>• Demonstrate list of duties for staff skill set</li> <li>• Demonstrate individual and teamwork for maintenance</li> <li>• Demonstrate standard maintenance procedures and guidelines.</li> </ul>                             | As Unit-1 |
|                                                                           |                                                                                                                                                                                                                                                                                                                                                                     | <b>Practical</b> <ul style="list-style-type: none"> <li>• Given a group of students perform supervisory role and assign duties.</li> <li>• Given a group of students perform standard maintenance procedures and guidelines.</li> </ul>                                                                                                                                                                                                                       |           |
| <b>LU4. Ensure</b>                                                        | The trainee must be able to:                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Describe tasks for maintenance schedule and their</li> </ul>                                                                                                                                                                                                                                                                                                                                                         | As Unit-1 |

|                                                                      |                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>timely maintenance to avoid negative outcomes</b>                 | <ul style="list-style-type: none"> <li>• Identify critical path in maintenance schedule</li> <li>• Ensure timely reminder are issued to the maintenance staff.</li> <li>• Ensure timely execution of activity in critical path.</li> <li>• Ensure strict adherence to overall maintenance schedule.</li> </ul> | <div> <div>duration</div> <ul style="list-style-type: none"> <li>• Describe generating reminder to maintenance staff for timely execution of maintenance tasks.</li> <li>• Describe key steps to implement complete maintenance in timely manner.</li> <li>• Demonstrate timely maintenance check-ups and key steps to implement complete maintenance.</li> </ul> </div> <div> <b>Practical</b> <ul style="list-style-type: none"> <li>• Implement timely maintenance check-ups and key steps to complete maintenance.</li> </ul> </div> |           |
| <b>LU5. Perform component / functionality test after maintenance</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify post maintenance test.</li> <li>• Follow instruction to perform post maintenance test as per standard operating procedure.</li> <li>• Perform corrective measure to make sure smooth operation of system</li> </ul>      | <div> <ul style="list-style-type: none"> <li>• Describe the list of post maintenance tests</li> <li>• Describe standard operating procedures for performing post maintenance tests</li> <li>• Demonstrate post maintenance tests to ensure system is behaving as expected</li> </ul> </div> <div> <b>Practical</b> <ul style="list-style-type: none"> <li>• Implement post maintenance functional testing against requirements/specifications</li> </ul> </div>                                                                          | As Unit-1 |
| <b>LU6. Generate maintenance report</b>                              | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Enlist results of functionality tests performed after maintenance</li> <li>• Formulate maintenance report</li> <li>• Propose any changes in maintenance plan</li> </ul>                                                           | <div> <ul style="list-style-type: none"> <li>• Describe the purpose of maintenance report</li> <li>• Describes steps for creating a maintenance report</li> <li>• Demonstrate maintenance report generation to review and manage information about equipment and its maintenance.</li> </ul> </div> <div> <b>Practical</b> </div>                                                                                                                                                                                                        | As Unit-1 |

|  |  |                                                                                                                                                       |  |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  | <ul style="list-style-type: none"> <li>• Generate maintenance report to review and manage information about Equipment and its maintenance.</li> </ul> |  |
|--|--|-------------------------------------------------------------------------------------------------------------------------------------------------------|--|

### Example and Illustrations



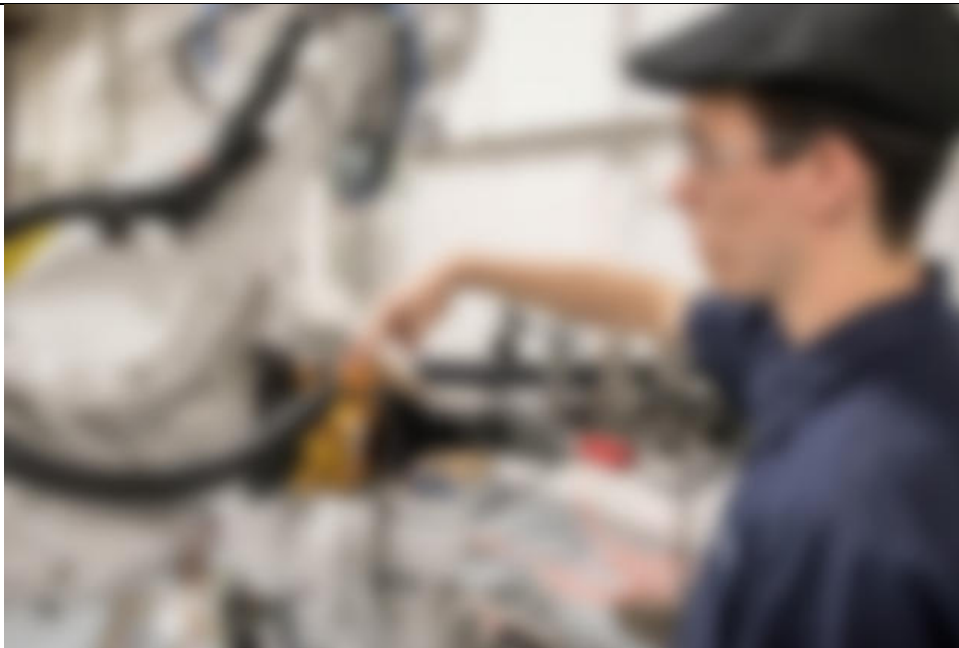
Perform maintenance of robotics

[https://www.youtube.com/watch?v=JS\\_a9txFYFc](https://www.youtube.com/watch?v=JS_a9txFYFc)



### How To Grease An Industrial Robot

<https://www.youtube.com/watch?v=t1RJGHWIVwM>



The use of robots have brought many benefits to manufacturers, but in order for them to continue seeing those benefits a robot equipment maintenance program must be implemented. The most common form of a robot maintenance program is preventive maintenance. Preventive maintenance is the planned maintenance of facilities and equipment, designed to eliminate unexpected breakdowns and increase the life span of robots. These programs are critical for the performance of a robot to remain reliable.

#### ***What is preventive maintenance?***

Preventive maintenance involves expanding the life of robotic equipment through [painting](#), lubrication, cleaning, adjusting, and minor part replacements. It uses testing, periodic inspections, and pre-planned maintenance activities in order to correct or prevent any problems that may arise. The main purpose is to keep breakdowns and decline to a

minimum.

### ***Advantages of Robotic Maintenance***

Most robots breakdown as a result of wear and tear, but preventive maintenance prevents this from happening for several years.

With the prevention of breakdowns manufacturers' productivity and quality are increased.

Costs are reduced through preservation of assets; meaning that robotic equipment lasts longer eliminating the spending of money to replace it year after year.

It also has the potential to produce greater ROI. With an increased life span, robots prove to be well worth the investment for manufacturers.

### ***Implementing Preventive Maintenance***

In order to have a successful preventive maintenance program it is important to execute a strict schedule with aggressive monitoring.

The program should focus on cleaning, lubrication, and fixing any problems found during inspections.

It is also critical to implement maintenance training among employees because warranties are limited. Having your own service personnel allows for quick repair time.

### ***When to Implement Preventive Maintenance Plans:***

These are the top reasons for implementing a preventive maintenance program. If your company has or is

|  |                                                                                                                                                                                                                                                                                                                                                                                |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>experiencing any of these then it may be time to start your own robotic maintenance program.</p> <p>Increased automation</p> <p>Production delays resulting in lost business</p> <p>Decreased insurance inventories</p> <p>Need for high quality products</p> <p>Excessive consumption of energy</p> <p>Disorganized working environment</p> <p>Slow manufacturing time</p> |
|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Module: 0714001073 Perform trouble shooting

**Objective of the Module:** This competency standard deals with identification and rectification of the problem occurred in the robotic system. The learner will be able to identify and resolve the problem according to the troubleshooting manual. It also helps the learner to prepare a comprehensive diagnostic report of the troubleshooting.

|           |                |  |         |    |           |    |
|-----------|----------------|--|---------|----|-----------|----|
| Duration: | Total hours 60 |  | Theory: | 12 | Practical | 48 |
|-----------|----------------|--|---------|----|-----------|----|

| Learning Unit                    | Learning Outcomes            | Learning Elements                                                                                   | Materials (Tools & Equipment) Required                                     |
|----------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>LU1. Identify the problem</b> | The trainee must be able to: | <ul style="list-style-type: none"> <li>Describe the steps to examine the robotic system.</li> </ul> | <ul style="list-style-type: none"> <li>Tool Kit (Electrical and</li> </ul> |

|                                                    |                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                              |                                                                                                                                               |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    | <ul style="list-style-type: none"> <li>• Examine the robotic system.</li> <li>• Enlist the identified problems.</li> <li>• Classify the problems.</li> </ul>                                                                                                        | <ul style="list-style-type: none"> <li>• Describe the list of common problems of a robotics system and their categories</li> </ul>                                                                                                                                                                           | Mechanical) <ul style="list-style-type: none"> <li>• Robotic Platform</li> <li>• Computers</li> <li>• Printers</li> <li>• Notepads</li> </ul> |
|                                                    |                                                                                                                                                                                                                                                                     | <b>Practical</b> <ul style="list-style-type: none"> <li>• Examine the robotic system and identify problem and its category</li> </ul>                                                                                                                                                                        |                                                                                                                                               |
| <b>LU2. Gather more details related to problem</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify reasons for the specified problem.</li> <li>• Observe the parameters and conditions at the time of problem occurred.</li> <li>• Prepare a detailed report on the problem.</li> </ul> | <ul style="list-style-type: none"> <li>• Describe the list of problems and causes.</li> <li>• Describe variations in parameters robot condition, during anomaly</li> <li>• Demonstrate report preparation to highlight problems in robotic system, variations in parameter and identified causes.</li> </ul> | As Unit-1                                                                                                                                     |
|                                                    |                                                                                                                                                                                                                                                                     | <b>Practical</b> <ul style="list-style-type: none"> <li>• Implement detailed report to highlight problems in robotic system, variations in parameter and identified causes.</li> </ul>                                                                                                                       | As Unit-1                                                                                                                                     |
| <b>LU3. Identify possible solutions</b>            | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify the troubleshooting manual.</li> </ul>                                                                                                                                               | <ul style="list-style-type: none"> <li>• Describe the usage of troubleshooting manual.</li> <li>• Describe the corrective measures for troubleshooting using manual.</li> </ul>                                                                                                                              | As Unit-1                                                                                                                                     |

|                                             |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                |           |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                             | <ul style="list-style-type: none"> <li>Specify the corrective measures from the troubleshooting manual.</li> <li>Arrange tools and equipment required to attempt fixing the problem.</li> </ul>                                                                                                            | <ul style="list-style-type: none"> <li>Describe tools and equipment required to attempt fixing the problem.</li> <li>Demonstrate the usage of troubleshooting manual.</li> <li>Demonstrate the corrective measures for troubleshooting using manual and equipment required to attempt fixing the problem.</li> </ul>                           |           |
|                                             |                                                                                                                                                                                                                                                                                                            | <b>Practical</b> <ul style="list-style-type: none"> <li>Implement troubleshooting using manual and equipment required to attempt fixing the problem.</li> </ul>                                                                                                                                                                                | As Unit-1 |
| <b>LU4. Attempt a fix based on findings</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Follow instructions from troubleshooting manual to resolve the problem.</li> <li>Gather more information and repeat if the problem is not resolved.</li> <li>Make a detailed report on rectification of the problem.</li> </ul> | <ul style="list-style-type: none"> <li>Explain instructions from troubleshooting manual.</li> <li>Describe the detailed report on rectification of the problem.</li> <li>Demonstrate trouble shooting using manual and repeat if the problem is not resolved.</li> <li>Demonstrate detailed report on rectification of the problem.</li> </ul> | As Unit-1 |
|                                             |                                                                                                                                                                                                                                                                                                            | <b>Practical</b> <ul style="list-style-type: none"> <li>Troubleshoot problems using manual and repeat if the problem is not</li> </ul>                                                                                                                                                                                                         |           |

|                                        |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                        |                                                                                                                                                                                                                                                                                      | <p>resolved.</p> <ul style="list-style-type: none"> <li>• Create a detailed report on rectification of the problem.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                     |           |
| <b>LU5. Generate diagnostic report</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Note the parameters and conditions after fixing the problem.</li> <li>• Prepare a comprehensive report on the observations and rectification of the problem.</li> <li>• Maintain error logs.</li> </ul> | <ul style="list-style-type: none"> <li>• Describe parameters and conditions that indicate cause of problem and their normal state after fixing the problem.</li> <li>• Describe the report on the observations and rectification of the problem.</li> <li>• Describe error logs.</li> <li>• Demonstrate identification of parameters and conditions that indicate cause of problem and their normal states after fixing the problem.</li> <li>• Demonstrate report on the observations and rectification of the problem and error logs.</li> </ul> | As Unit-1 |
|                                        |                                                                                                                                                                                                                                                                                      | <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Implement identification of parameters and conditions that indicate cause of problem.</li> <li>• Implement report on the observations and rectification of the problem and error logs.</li> </ul>                                                                                                                                                                                                                                                                                 |           |

## Examples and Illustrations



## Preventative Maintenance 101: Robot Cables

<https://www.youtube.com/watch?v=DHbxGr8cBfM>



## Automated Manufacturing Robots

<https://www.youtube.com/watch?v=s-yne8xTNM0>



### Troubleshooting Robotics Gear box

<https://www.youtube.com/watch?v=iPEZkcWE0ZI>



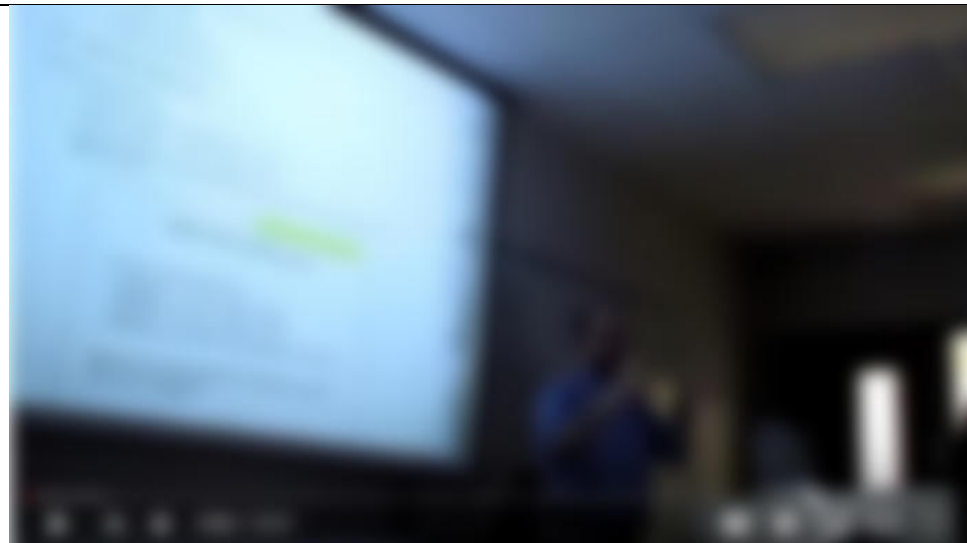
### How to change gear box oil of ABB Robot 1st Axis/ on the job

<https://www.youtube.com/watch?v=wCFleEp1zMc>



### EZ-Robot Diagnostic

<https://www.youtube.com/watch?v=8fVTJtn5J8>



### Error and Fault Recovery in Fanuc Robotic Controller

<https://www.youtube.com/watch?v=uOYctsuNOyo>

## Module: 0714001074 Revise the configuration of robotics

**Objective of the Module:** This Competency Standard covers the required skills and knowledge for revising configuration of the robotic system according to the need of specified task. The trainee will be able to learn how to identify and reconfigure software and hardware modules of the robotic system as per desired task.

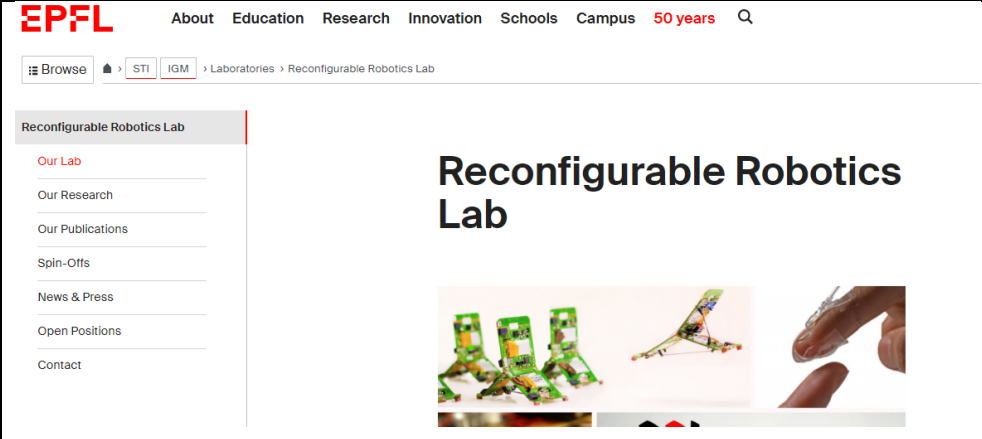
|           |             |        |         |        |           |        |
|-----------|-------------|--------|---------|--------|-----------|--------|
| Duration: | Total hours | 50 Hrs | Theory: | 10 Hrs | Practical | 40 Hrs |
|-----------|-------------|--------|---------|--------|-----------|--------|

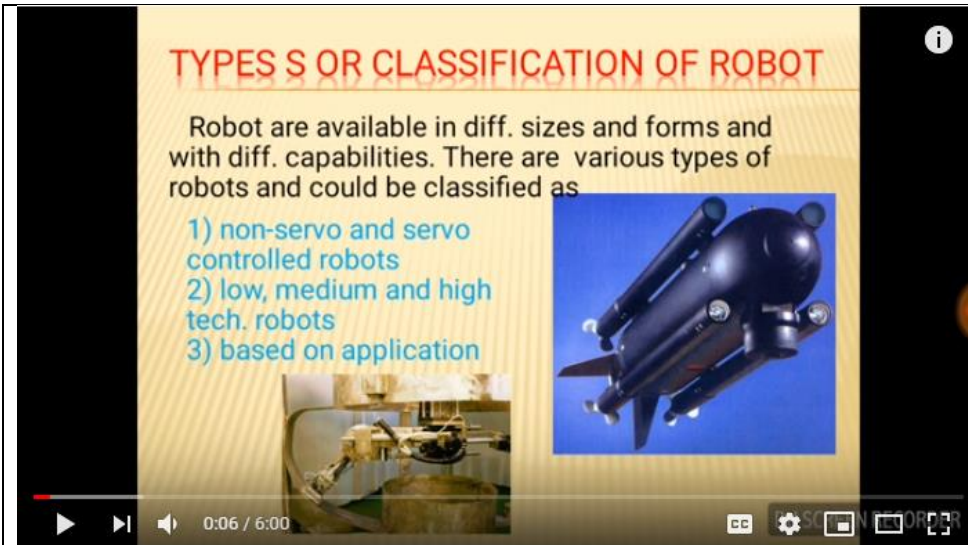
| Learning Unit                                          | Learning Outcomes                                                                                                                                                                                                                         | Learning Elements                                                                                                                                                                                                                                                                                                                 | Materials (Tools & Equipment) Required                                                     |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <b>LU1. Verify detailed functionality of equipment</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify functionality tests for checking robot</li> <li>Perform functionality test for robot</li> <li>Ensure proper functionality of the equipment</li> </ul> | <ul style="list-style-type: none"> <li>Describe functionality tests</li> <li>Describe the procedure for conducting functionality tests</li> <li>Demonstrate functionality tests Practical</li> <li>Given a robotic equipment, perform functionality tests as per requirement to verify that it is functioning properly</li> </ul> | <p>Robotic System</p> <p>Mechanical Tool Kit</p> <p>Electronic Tool Kit</p> <p>Laptops</p> |
| <b>LU2. Verify detailed functionality of interface</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Identify interfacing modules</li> </ul>                                                                                                                        | <ul style="list-style-type: none"> <li>Describe various interfaces of robotic components</li> <li>Describe various functionality tests for testing the functionality of interfaces</li> <li>Demonstrate functionality tests of interfaces Practical</li> <li>Given robotic components with various interfaces, perform</li> </ul> |                                                                                            |

|                                                                      |                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                      | for robot <ul style="list-style-type: none"> <li>• Perform functionality test</li> <li>• Ensure proper functionality of the interface modules</li> </ul>                                                                                                                      | functionality testing of those interfaces to ensure proper functionality                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
| <b>LU3. Identify task that require re-configuration of equipment</b> | The trainee must be able to: <ul style="list-style-type: none"> <li>• Specify the task which will require re configuration.</li> <li>• List required tool and equipment for reconfiguration.</li> <li>• List down robotic components necessary for reconfiguration</li> </ul> | <ul style="list-style-type: none"> <li>• Describe various configurations of robotic systems</li> <li>• Demonstrate how to identify tasks that require reconfiguration</li> <li>• Describe tools and equipment that can be used for reconfiguration</li> <li>• Describe various robotic components that can be used for reconfiguration.</li> </ul> <b>Practical</b> <ul style="list-style-type: none"> <li>• Given a robotic system that needs to be reconfigured for some other task, identify the components that require reconfigurations and provide a list of equipment, tools and robotic components that will be required</li> </ul> | As Unit-1 |
| <b>LU4. Ensure of integration reconfigured equipment</b>             | The trainee must be able to: <ul style="list-style-type: none"> <li>• Arrange robotic components necessary for reconfiguration</li> <li>• Identify standard procedure for integration</li> <li>• Perform integration of reconfigured equipment</li> </ul>                     | <ul style="list-style-type: none"> <li>• Describe robotics components that can be reconfigured</li> <li>• Describe the standard procedure for reconfiguring robotic component</li> <li>• Describe the procedure for performing integration</li> <li>• Demonstrate integration of reconfigured components</li> </ul> <b>Practical</b> <ul style="list-style-type: none"> <li>• Given a robotic system with reconfigure components, perform integration of the reconfigured components</li> </ul>                                                                                                                                             | As Unit-1 |
| <b>LU5. Upgrade software modules</b>                                 | The trainee must be able to: <ul style="list-style-type: none"> <li>• Identify software modules that require up gradation</li> <li>• Backup existing software</li> </ul>                                                                                                      | <ul style="list-style-type: none"> <li>• Describe procedure for backup of software and configuration</li> <li>• Describe procedure for upgradation of software modules</li> <li>• Describe procedure for identify software modules that required upgradation</li> <li>• Demonstrate backup of software and configuration</li> <li>• Demonstrate upgradation of software modules</li> </ul> <b>Practical</b> <ul style="list-style-type: none"> <li>• Given a robotic system, perform backup of the existing</li> </ul>                                                                                                                      | As Unit-1 |

|                                                                         |                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                                                                         | <p>and configuration.</p> <ul style="list-style-type: none"> <li>• Perform up gradation of software modules according to the SOP.</li> </ul>                                                                                                                                                                                | <p>software and configuration. Identify modules that require upgradation and perform upgradation of those modules</p>                                                                                                                                                                                                                                                                                                                                                              |                  |
| <p><b>LU6. Ensure testing and smooth functionality of equipment</b></p> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify standard testing procedures.</li> <li>• Perform functionality test of the reconfigured equipment</li> <li>• Ensure proper functionality of the reconfigured equipment</li> <li>• Maintain log of equipment reconfiguration</li> </ul> | <ul style="list-style-type: none"> <li>• Describe standard testing procedures</li> <li>• Describe standard procedure for maintaining log</li> <li>• Demonstrate functionality testing of reconfigured component</li> <li>• Demonstrate maintaining equipment log</li> </ul> <p>Practical</p> <ul style="list-style-type: none"> <li>• Given a reconfigured robotic system, perform functionality testing of the reconfigured components and prepare reconfiguration log</li> </ul> | <p>As unit-1</p> |

## Examples and Illustrations

|                                                                                     |                                                                                                                       |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
|  | <h3>Reconfigurable Robotics Lab</h3> <p><a href="https://www.epfl.ch/labs/rrl/">https://www.epfl.ch/labs/rrl/</a></p> |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|



Types of Robot and various Configuration

<https://www.youtube.com/watch?v=Pb706BLc7gk>



Upgrade software modules

<https://www.youtube.com/watch?v=YmVVgDfh1gs>



How to: Software and Firmware Update on a Universal Robot

<https://www.youtube.com/watch?v=1HFZ5vXjR0Q>



## Ensure testing and smooth functionality of equipment

### Preventative Maintenance for Industrial Robots

Every robot needs preventative maintenance ensure top-level performance and consistency on the production line. When robots do not have regular preventative maintenance checks performed, it can cause parts and components to break down or malfunction, which can cause a slowdown or shutdown of your production. Industrial robots that are properly maintained can last for many years, even decades, before needing to be replaced. By keeping a regular preventative maintenance schedule, you are extending the life of your robot exponentially.

Different robotics companies recommend different amounts of time between preventative maintenance. For example, FANUC Robotics states that planned preventative maintenance for your industrial robot should be performed every 3,850 hours or 12 months, whichever comes first for your robot. However, KUKA Robotics recommends preventative maintenance after 10,000 hours for their robots. It is important to check the manual for your specific robot to see what time frame is best.

|  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p>No matter what length of time your manual recommends, by scheduling maintenance in this way, you are able to prevent costly downtime that is unplanned due to mechanic issues. While planned maintenance may shut down production for a short time, it is nothing compared to the production time you may lose if your robot stops working.</p> <p>So, what takes place during routine preventative maintenance checkups? Here are some recommended maintenance tips to schedule throughout the life of your robot:</p> <p>Backing up the controller memory</p> <p>Monitor robot in regular motion, inspecting robot, harness and cables</p> <p>Inspection of brake operation</p> <p>Check robot repeatability</p> <p>Listen for excessive audible vibration and noise</p> <p>Grease joints, according to specific robot manual (or analyze grease if already performed)</p> <p>Visual inspection of teach pendant and controller cables</p> <p>Check cable connections, cooling fans, power supplies, safety equipment, and other equipment for functionality</p> <p>Test and replace RAM and APC batteries, if required</p> <p>Clean vents and filters with compressed air</p> <p>Grease bushing and balancer</p> <p>Tighten external bolts</p> <p>Replace batteries in controller and robot arm when necessary</p> <p>If any further action is required and the robot needs repairs, the technician should report the issues so arrangement can be made to make the needed repairs.</p> |
|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Module: 0714001075 Execute up-gradation of robotics

**Objective of the Module:** This Competency Standard covers the required skills and knowledge for execution of up-gradation of robotic equipment. The trainee will be able to learn about identification process of equipment up-gradation, installation of software, hardware components and post operating tests.

|           |             |    |         |   |           |    |
|-----------|-------------|----|---------|---|-----------|----|
| Duration: | Total hours | 50 | Theory: | 8 | Practical | 32 |
|-----------|-------------|----|---------|---|-----------|----|

| Learning Unit                                                     | Learning Outcomes                                                                                                                                                                                                                                             | Learning Elements                                                                                                                                                                                                                                                        | Materials (Tools & Equipment) Required                                                                                                                                                       |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Identify current state of equipment for up- gradation</b> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify reason for up-gradation of equipment</li> <li>• Identify tasks and related component that need up-gradation</li> <li>• Ensure need to upgrade equipment</li> </ul>      | <ul style="list-style-type: none"> <li>• Describe the advancement in Robotics Instrumentation</li> <li>• Summarize the production difference using advance instruments</li> <li>• Explain rate of increase of production rate using upgraded equipment.</li> </ul>       | <ul style="list-style-type: none"> <li>• Robotic system</li> <li>• Mechanical tool kit</li> <li>• Electrical tool Kit</li> <li>• Personal Computers / Laptops</li> <li>• Notebook</li> </ul> |
| <b>LU2. Recommend up-gradation of specific equipment</b>          | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• List components of equipment need to be upgraded</li> <li>• List the new upgraded equipment</li> <li>• Prepare report on recommended equipment</li> </ul>                        | <ul style="list-style-type: none"> <li>• Identify the upgrade able instruments and their substandard.</li> <li>• Describe briefly the advance technology regarding the factory plant.</li> <li>• Illustrate the extended features of recommended instruments.</li> </ul> | As unit-1                                                                                                                                                                                    |
| <b>LU3. Install / replace software modules</b>                    | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify software module that needs replacement</li> <li>• Follow standard procedure for up-gradation of software modules</li> <li>• Report software modules upgraded</li> </ul> | <ul style="list-style-type: none"> <li>• Outline out-dated features of software module.</li> <li>• Explain step by step procedure of software update.</li> <li>• Describe how to prepare report of software up gradation.</li> </ul>                                     | As unit-1                                                                                                                                                                                    |

|                                                   |                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                 |           |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>LU4. Install / replace physical components</b> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Identify physical component that need replacement</li> <li>• Follow standard procedure for up-gradation of physical modules</li> <li>• Report physical components upgraded</li> <li>• Ensure proper packaging and storage of replaced modules</li> </ul> | <ul style="list-style-type: none"> <li>• Outline out-dated key points of physical component.</li> <li>• Explain step by step procedure of physical module up gradation.</li> <li>• Illustrate how to prepare report for physical module up gradation.</li> <li>• Interpret industrial storage system for warehouses.</li> </ul> | As unit-1 |
| <b>LU5. Perform post up-gradation test</b>        | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• List post up-gradation tests</li> <li>• Follow post up-gradation test as per standard operating procedure</li> <li>• Evaluate and report post up-gradation tests results</li> </ul>                                                                      | <ul style="list-style-type: none"> <li>• Summarize post up gradation techniques for particular robot.</li> <li>• Describe step by step procedure for up gradation.</li> <li>• explain how to generate report for an up graded system.</li> </ul>                                                                                | As unit-1 |
| <b>LU6. Ensure expected outcomes</b>              | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• List expected outcome of up-gradation</li> <li>• Compare expected and evaluated post up-gradation results</li> <li>• Ensure corrective measures to achieve expected outcome</li> </ul>                                                                   | <ul style="list-style-type: none"> <li>• Explain the expected changes after up gradation.</li> <li>• Determine gap analysis by a comparison between expected and actual result.</li> <li>• Describe in detail the ways to achieve the goal.</li> </ul>                                                                          | As unit-1 |

## Examples and Illustrations

## INTRODUCTION

- ▶ First Industrial Revolution was substitution of Mech. Energy for muscle power
- ▶ Second revolution based on substitution of computer for human brain in control of machine and Industrial Processes
- ▶ Out of this second revolution have emerged the Industrial Robot.



### Introduction and History of Robots

This example shows the upgradation of robot with revaluation of robotics.

<https://www.youtube.com/watch?v=62e8c6ErWE8>

### Installing Our KUKA KR-350/1 Industrial Robot (Project Jeff)

[https://www.youtube.com/watch?v=dYzeID\\_6JjY](https://www.youtube.com/watch?v=dYzeID_6JjY)





## The Robot Revolution: The New Age of Manufacturing | Moving Upstream

<https://youtu.be/HX6M4QunVmA>

### Module: 0714001076 Develop 3D simulations

**Objective of the Module:** The objective of this exercise is to have the knowledge and understanding of 3D simulations. This includes managing 3D modeling tools, building and simulating 3D models, generating coordinating systems for 3D models, and testing generated G-Codes.

|           |             |        |         |       |           |        |
|-----------|-------------|--------|---------|-------|-----------|--------|
| Duration: | Total hours | 40 Hrs | Theory: | 8 Hrs | Practical | 32 Hrs |
|-----------|-------------|--------|---------|-------|-----------|--------|

| Learning Unit                         | Learning Outcomes                                                                                                                                                                                                                          | Learning Elements                                                                                                                                                                                                                                                                                                                                      | Materials (Tools & Equipment) Required                                                                                                                                                  |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LU1. Manage 3D modelling tools</b> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>List the available modelling tools</li> </ul> <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>Select the required/related</li> </ul> | <ul style="list-style-type: none"> <li>Describe various modelling tools</li> <li>Demonstrate selection of modelling tool based on requirements</li> <li>Describe how to maintain documentation of modelling tool compatibility</li> <li>Demonstrate how to upgrade modelling tools</li> <li>Demonstrate how to troubleshoot modelling tools</li> </ul> | <ul style="list-style-type: none"> <li>3D modeling tools (e.g. AutoCAD, Google sketches)</li> <li>3D simulation tools (e.g. Proteus and other simulation software of robots)</li> </ul> |

|                                            |                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                 |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
|                                            | modelling tools <ul style="list-style-type: none"> <li>Keep an up to date documentation of modelling tools with respect to compatibility</li> <li>Upgrading and troubleshooting modelling tools</li> </ul>                                                                                                                                                                                      | <b>Practical</b> <ul style="list-style-type: none"> <li>Given a set of modelling tools, prepare documentation to manage the tools, perform upgradation of the tools, perform troubleshooting</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Laptop (for running software)</li> </ul> |
| <b>LU2. Build models in 3D environment</b> | The Trainee must be able to: <ul style="list-style-type: none"> <li>List the available simulation modes.</li> <li>Select the required simulation mode.</li> <li>Interpret the given design specifications</li> <li>Formulate the procedure to design the model</li> <li>Design the model according to specifications</li> <li>Cross-check design specifications with the built model</li> </ul> | <ul style="list-style-type: none"> <li>Describe various simulation modes</li> <li>Demonstrate selection of simulation mode based on requirements</li> <li>Describe how to interpret design specification</li> <li>Describe the standard procedure for designing the model</li> <li>Demonstrate designing the model according to specification</li> <li>Demonstrate how to validate the model against the given specification.</li> </ul> <b>Practical</b> <ul style="list-style-type: none"> <li>Given a design specification, prepare a 3D model according to specification and cross-check the specification with the built model</li> </ul> | As unit-1                                                                       |
| <b>LU3. Simulate 3D models</b>             | The Trainee must be able to: <ul style="list-style-type: none"> <li>Prepare modelling tool for simulation.</li> <li>Run basic simulation according to specifications</li> <li>Generate basic G-codes</li> <li>Prepare feasibility report</li> </ul>                                                                                                                                             | <ul style="list-style-type: none"> <li>Describe how to use simulation mode in modelling tool</li> <li>Demonstrate how to run simulation</li> <li>Describe basics of G-code</li> <li>Demonstrate how to generate G-codes</li> <li>Describe how to prepare a feasibility report</li> <li>Demonstrate preparation of feasibility report.</li> </ul> <b>Practical</b> <ul style="list-style-type: none"> <li>Given a 3D model, run simulation on the model and generate G-codes. Also prepare a feasibility report</li> </ul>                                                                                                                      | As unit-1                                                                       |

|                                                                 |                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| <b>LU4. Convert / generate coordinating system for 3D model</b> | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Generate system coordinates according to deployment requirements</li> <li>• Translate generated coordinates to physical workplace</li> </ul>                                                            | <ul style="list-style-type: none"> <li>• Describe coordinate conversion process</li> <li>• Demonstrate how to generate systems coordinates based on requirements</li> <li>• Demonstrate how to translate generated coordinate to physical coordinates.</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Given a 3D Model, generate system coordinates and then translate them to physical workspace</li> </ul>                                                | <p>As unit-1</p> |
| <b>LU5. Test generated G-Code</b>                               | <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> <li>• Set up working environment for sample testing</li> <li>• Acquire sample work piece</li> <li>• Perform practical implementation of the generated G-code</li> <li>• Prepare performance report</li> </ul> | <ul style="list-style-type: none"> <li>• Describe how to setup working environment</li> <li>• Describe work piece requirements and selection process</li> <li>• Demonstrate how to process work piece using G-codes</li> <li>• Demonstrate how to prepare performance report.</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>• Given G-codes generated from a 3D model, implement the G-code on physical work piece and prepare performance report</li> </ul> | <p>As unit-1</p> |

## Examples and Illustrations



**MATLAB and Simulink**  
Robotics Arena



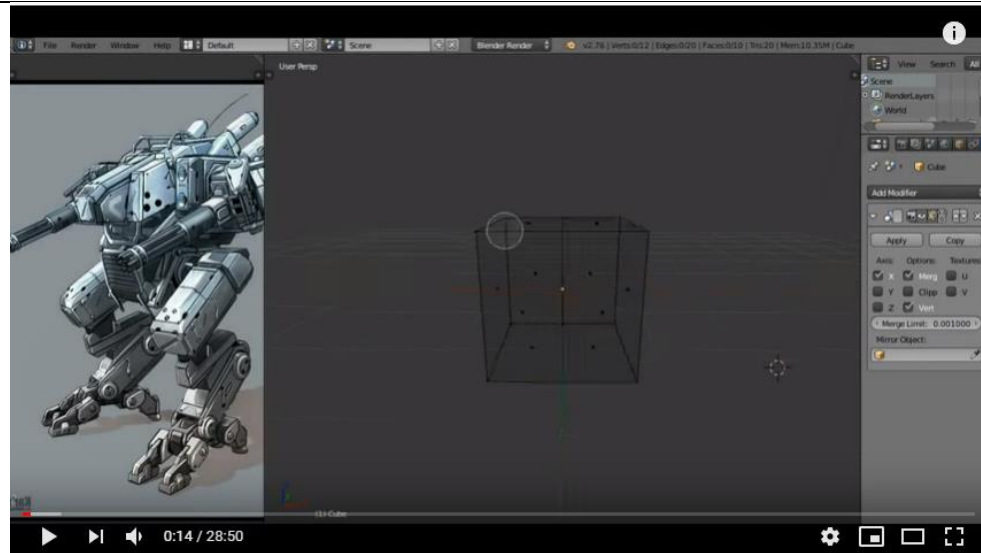
## Designing Robot Manipulator Algorithms

Jose Avendano  
Sebastian Castro

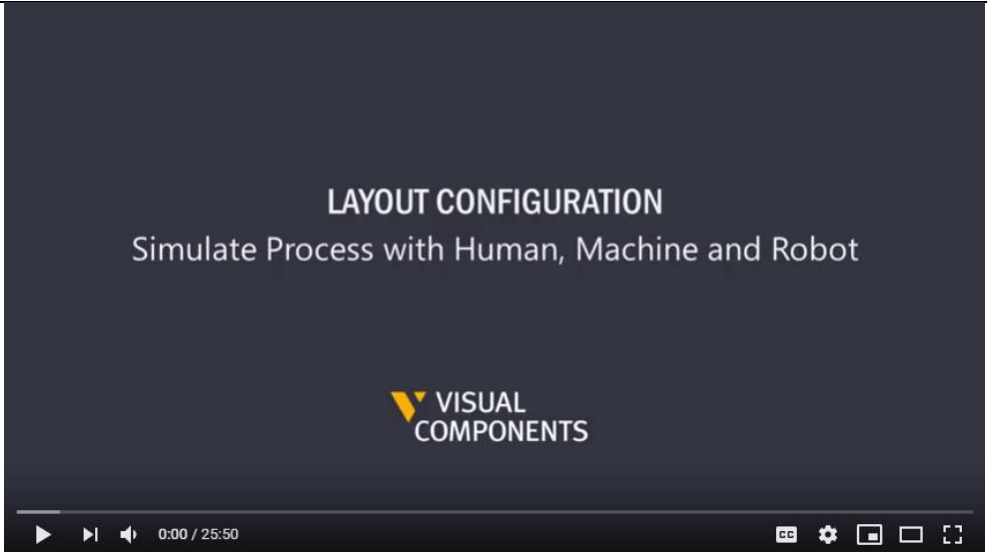
0:00 / 28:21

## Designing Robot Manipulator Algorithms

<https://youtu.be/5DnKot3mMSc>



<https://youtu.be/U-eO5zu2onA>



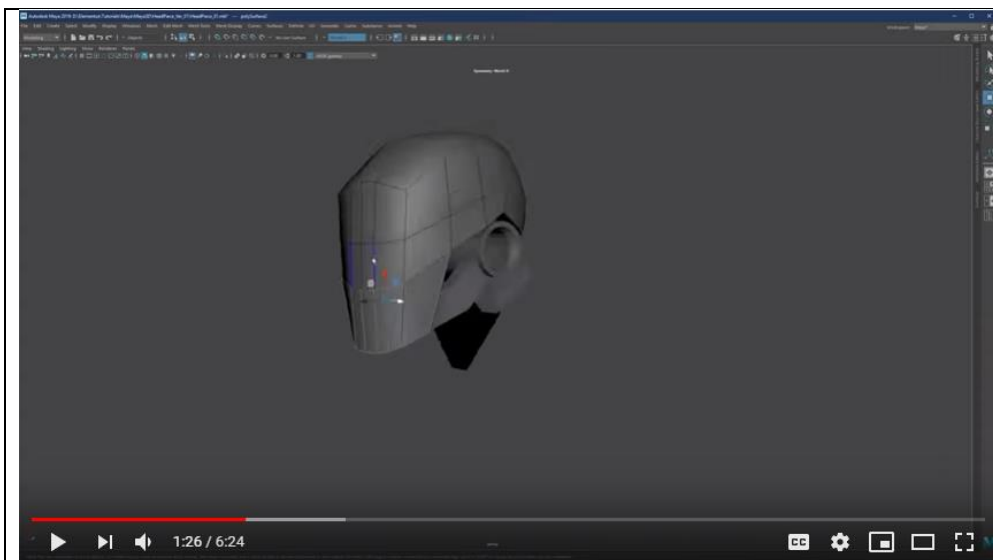
**Simulate Process with Human, Machine and Robot**

<https://youtu.be/gtARDPBnhNI>



**How to Create MATLAB GUI - robot arm simulation**

<https://youtu.be/xF1KaINQwa8>



### 3D Modeling in Maya // Robotic Design Course

<https://youtu.be/Xulmmvqxpao>

## Module: 0714001077 Assist engineers in design, configuration and application

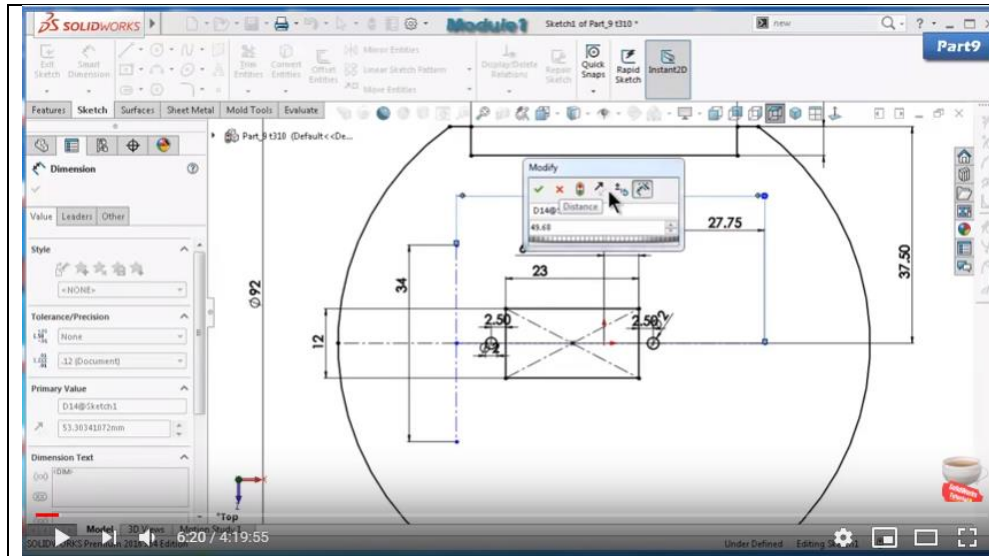
**Objective of the Module:** This competency standard explains how to assist engineers in executing the design process, managing tools/equipment and perform equipment tests according to given plan. The learner will be able to understand the design process, management of tools and equipment and performing equipment tests according to manuals after completing this competency.

|           |             |    |         |   |           |    |
|-----------|-------------|----|---------|---|-----------|----|
| Duration: | Total hours | 30 | Theory: | 6 | Practical | 24 |
|-----------|-------------|----|---------|---|-----------|----|

| Learning Unit                                        | Learning Outcomes                                                                                                                                                                                                                                           | Learning Elements                                                                                                                                                                                                                                          | Materials (Tools & Equipment) Required                                                                                                                                                 |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CU1. Execute repetitive/manual design process</b> | <p>The trainee must be able to:</p> <ul style="list-style-type: none"> <li>Collect the design process instruction from an Engineer.</li> <li>Follow the instructions to execute the design process.</li> <li>Report problems occurred during the</li> </ul> | <ul style="list-style-type: none"> <li>Describe the types of engineering drawing.</li> <li>What are the basic components of engineering drawing?</li> <li>Why are engineering drawings important?</li> <li>How do you read engineering drawing?</li> </ul> | <ul style="list-style-type: none"> <li>Tool Kits (electrical and mechanical)</li> <li>Test bench</li> <li>Computers</li> <li>Printers</li> <li>Tools for system calibration</li> </ul> |

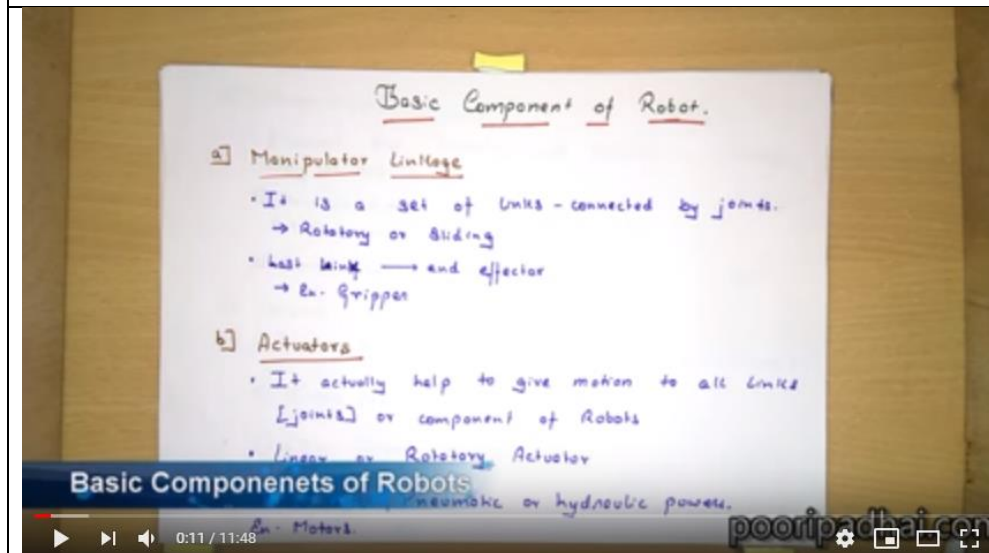
|                                       |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                       |           |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                       | design process.                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                       |           |
| <b>CU2.Manage tools and equipment</b> | <ul style="list-style-type: none"> <li>• Identify tools and equipment to be used.</li> <li>• Follow instructions to arrange and calibrate the tools and equipment.</li> <li>• Ensure availability of tools and equipment for a specified job.</li> <li>• Gather the tools and equipment after completion of the job.</li> </ul> | <ul style="list-style-type: none"> <li>• What tools do you need to make a robot?</li> <li>• How do you start making a robot?</li> <li>• Which software is used in robotics?</li> <li>• What is instrument and instrumentation?</li> <li>• Why instrumentation is required?</li> </ul> | As Unit-1 |
| <b>CU3. Execute test plan</b>         | <ul style="list-style-type: none"> <li>• Prepare the test environment.</li> <li>• Arrange test tools and equipment.</li> <li>• Follow instruction to perform test.</li> <li>• Report the results of the executed test.</li> </ul>                                                                                               | <ul style="list-style-type: none"> <li>• What is the purpose of testing an installation?</li> <li>• What is testing and inspection in electrical installation?</li> <li>• What is Robot testing?</li> <li>• What tools do you need to make a robot?</li> </ul>                        | As Unit-1 |

## Examples and illustrations



In this example, the SolidWorks application is used to design Robotic arm (layout design, mate controller) from 2D design.

<https://www.youtube.com/watch?v=pVY0Wt4LXUs>



Basic component of robot

[https://www.youtube.com/watch?v=JD9v2zR\\_MRw](https://www.youtube.com/watch?v=JD9v2zR_MRw)

## Topics For Today's Session

- 1 What is Automation?
- 2 What is UiPath?
- 3 Automation Examples in UiPath

# UiPath

SUBSCRIBE

0:34 / 45:25

RPA Training using UiPath

www.edureka.co/robot

## Engineering Design Process

0:03 / 3:04

UiPath Automation Examples | Top 5 Automation Examples in UiPath  
| RPA UiPath Training | Edureka

<https://youtu.be/-KAjgwWF0hY>

In this example the learner will be able to know about the Engineering Design Process -

<https://youtu.be/KpWrHVo972g>

|                 |          |                                                                              |   |                    |
|-----------------|----------|------------------------------------------------------------------------------|---|--------------------|
| <b>Question</b> | <b>1</b> | _____ is a drawing giving details about size tolerance, heat treatment, etc. | A | Exploded drawing   |
|                 |          |                                                                              | B | Production drawing |
|                 |          |                                                                              | C | Assembly drawing   |
|                 |          |                                                                              | D | Machine drawing    |
|                 |          |                                                                              |   |                    |
| <b>Question</b> | <b>2</b> | Detailed drawing of each part of a machine is called.----- _____             | A | Part drawing       |
|                 |          |                                                                              | B | assembly drawing   |
|                 |          |                                                                              | C | patent drawing     |
|                 |          |                                                                              | D | tabular drawing    |
|                 |          |                                                                              |   |                    |

|                 |          |                                                                                                |   |                                   |
|-----------------|----------|------------------------------------------------------------------------------------------------|---|-----------------------------------|
| <b>Question</b> | <b>3</b> | In which operation, motion of job is rotary and motion of cutting tool is forward translating? | A | turning                           |
|                 |          |                                                                                                | B | planning                          |
|                 |          |                                                                                                | C | milling                           |
|                 |          |                                                                                                | D | all of the mentioned              |
|                 |          |                                                                                                |   |                                   |
| <b>Question</b> | <b>4</b> | Which type of cutting tools have wide application on lathes?                                   | A | multi point                       |
|                 |          |                                                                                                | B | single point                      |
|                 |          |                                                                                                | C | both single point and multi point |
|                 |          |                                                                                                | D | none of the mentioned             |
|                 |          |                                                                                                |   |                                   |

|                 |          |                                                   |   |                   |
|-----------------|----------|---------------------------------------------------|---|-------------------|
| <b>Question</b> | <b>5</b> | In how many groups, cutting tools can be divided? | A | 2                 |
|                 |          |                                                   | B | 3                 |
|                 |          |                                                   | C | 4                 |
|                 |          |                                                   | D | None of the Above |
|                 |          |                                                   |   |                   |

|                 |          |                                                                |   |                                |
|-----------------|----------|----------------------------------------------------------------|---|--------------------------------|
| <b>Question</b> | <b>6</b> | Which kind of resistance is experienced in upset butt welding? | A | Thermal resistance             |
|                 |          |                                                                | B | Magnetic resistance            |
|                 |          |                                                                | C | Electric resistance            |
|                 |          |                                                                | D | d) Air resistance              |
| <b>Question</b> | <b>7</b> | Resistances can be measured with the help of a -----           | A | Wattmeter                      |
|                 |          |                                                                | B | voltmeter                      |
|                 |          |                                                                | C | ammeter                        |
|                 |          |                                                                | D | ohmmeter and resistance bridge |
|                 |          |                                                                |   |                                |

|                 |          |                                                                                                  |   |                        |
|-----------------|----------|--------------------------------------------------------------------------------------------------|---|------------------------|
| <b>Question</b> | <b>8</b> | The use of----- instruments is merely confined within laboratories as standardizing instruments. | A | absolute               |
|                 |          |                                                                                                  | B | indicating             |
|                 |          |                                                                                                  | C | recording              |
|                 |          |                                                                                                  | D | integrating            |
|                 |          |                                                                                                  |   |                        |
| <b>Question</b> | <b>9</b> | Which of the following have a low loading effect?                                                | A | Electrical system      |
|                 |          |                                                                                                  | B | Electronic system      |
|                 |          |                                                                                                  | C | Both have equal effect |
|                 |          |                                                                                                  | D | None of the mentioned  |
|                 |          |                                                                                                  |   |                        |

|                 |           |                                                                             |   |            |
|-----------------|-----------|-----------------------------------------------------------------------------|---|------------|
| <b>Question</b> | <b>10</b> | To increase the current sensitivity below 10 mV, electronic instrument uses | A | Oscillator |
|                 |           |                                                                             | B | Modulator  |
|                 |           |                                                                             | C | Transducer |
|                 |           |                                                                             | D | Amplifiers |
|                 |           |                                                                             |   |            |
| <b>Question</b> | <b>11</b> | What is the least count of a micrometer?                                    | A | 0.01 mm    |
|                 |           |                                                                             | B | 0.02 mm    |
|                 |           |                                                                             | C | 0.1 mm     |
|                 |           |                                                                             | D | 0.2 mm     |
|                 |           |                                                                             |   |            |

|                 |           |                                                                             |   |                |
|-----------------|-----------|-----------------------------------------------------------------------------|---|----------------|
| <b>Question</b> | <b>12</b> | In physics, a common instrument to measure diameter of a circle is known as | A | rule           |
|                 |           |                                                                             | B | measuring tape |
|                 |           |                                                                             | C | calipers       |
|                 |           |                                                                             | D | inch tape      |
|                 |           |                                                                             |   |                |
| <b>Question</b> | <b>13</b> | Error due to eye vision is termed as                                        | A | climax error   |
|                 |           |                                                                             | B | sight error    |
|                 |           |                                                                             | C | parallax error |
|                 |           |                                                                             | D | visional error |
|                 |           |                                                                             |   |                |

|                 |           |                                                               |   |                                                                 |
|-----------------|-----------|---------------------------------------------------------------|---|-----------------------------------------------------------------|
| <b>Question</b> | <b>14</b> | Which of the following is incorrect for Vernier height gauge? | A | Surface plate is used as datum surface for measurements         |
|                 |           |                                                               | B | These gauges can be used for scribing purposes                  |
|                 |           |                                                               | C | Removable clamps are used                                       |
|                 |           |                                                               | D | Both the surfaces of measuring jaw should be at 45° to the base |
|                 |           |                                                               |   |                                                                 |
| <b>Question</b> | <b>15</b> | What is the total error in micrometer?                        | A | Positive and negative deviation from the zero point             |
|                 |           |                                                               | B | Error in parallelism                                            |
|                 |           |                                                               | C | Deviation from measurement of a nominal dimension               |
|                 |           |                                                               | D | Maximum difference between ordinates of cumulative error        |
|                 |           |                                                               |   |                                                                 |

|                 |           |                                                                                                            |   |                                                          |
|-----------------|-----------|------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------|
| <b>Question</b> | <b>16</b> | A measuring tape can measure length more than a/an                                                         | A | meter                                                    |
|                 |           |                                                                                                            | B | inch but less than a foot                                |
|                 |           |                                                                                                            | C | foot but less than a meter                               |
|                 |           |                                                                                                            | D | centimeter                                               |
| <b>Question</b> | <b>17</b> | Why these 4 elements (confidentiality, integrity, authenticity & availability) are considered fundamental? | A | They help understanding hacking better                   |
|                 |           |                                                                                                            | B | They are key elements to a security breach               |
|                 |           |                                                                                                            | C | They help understands security and its components better |
|                 |           |                                                                                                            | D | They help to understand the cyber-crime better           |
|                 |           |                                                                                                            |   |                                                          |

|                 |           |                                                                                  |   |                               |
|-----------------|-----------|----------------------------------------------------------------------------------|---|-------------------------------|
| <b>Question</b> | <b>18</b> | _____ ensures the integrity and security of data that are passing over a network | A | Firewall                      |
|                 |           |                                                                                  | B | Antivirus                     |
|                 |           |                                                                                  | C | Pentesting Tools              |
|                 |           |                                                                                  | D | Network-security protocols    |
|                 |           |                                                                                  |   |                               |
| <b>Question</b> | <b>19</b> | SSL primarily focuses on _____                                                   | A | Integrity and authenticity    |
|                 |           |                                                                                  | B | Integrity and non-repudiation |
|                 |           |                                                                                  | C | Authenticity and privacy      |
|                 |           |                                                                                  | D | Confidentiality and integrity |
|                 |           |                                                                                  |   |                               |

|                 |           |                                                            |   |                       |
|-----------------|-----------|------------------------------------------------------------|---|-----------------------|
| <b>Question</b> | <b>20</b> | Which of the following are forms of malicious attack?      | A | Theft of information  |
|                 |           |                                                            | B | Modification of data  |
|                 |           |                                                            | C | Wiping of information |
|                 |           |                                                            | D | All of the mentioned  |
|                 |           |                                                            |   |                       |
| <b>Question</b> | <b>21</b> | From the following, which is not a common file permission? | A | Write                 |
|                 |           |                                                            | B | Execute               |
|                 |           |                                                            | C | Stop                  |
|                 |           |                                                            | D | Read                  |
|                 |           |                                                            |   |                       |

|                 |           |                                                                                |   |                |
|-----------------|-----------|--------------------------------------------------------------------------------|---|----------------|
| <b>Question</b> | <b>22</b> | Which of the following is the least secure method of authentication?           | A | Key card       |
|                 |           |                                                                                | B | fingerprint    |
|                 |           |                                                                                | C | retina pattern |
|                 |           |                                                                                | D | Password       |
|                 |           |                                                                                |   |                |
| <b>Question</b> | <b>23</b> | What is the name for information sent from robot sensors to robot controllers? | A | emperature     |
|                 |           |                                                                                | B | b) pressure    |
|                 |           |                                                                                | C | feedback       |
|                 |           |                                                                                | D | d) signal      |
|                 |           |                                                                                |   |                |

|                 |           |                                                                             |   |                  |
|-----------------|-----------|-----------------------------------------------------------------------------|---|------------------|
| <b>Question</b> | <b>24</b> | What is the name for space inside which a robot unit operates?              | A | environment      |
|                 |           |                                                                             | B | spatial base     |
|                 |           |                                                                             | C | work envelope    |
|                 |           |                                                                             | D | exclusion zone   |
|                 |           |                                                                             |   |                  |
| <b>Question</b> | <b>25</b> | Which of the following terms IS NOT one of the five basic parts of a robot? | A | peripheral tools |
|                 |           |                                                                             | B | end effectors    |
|                 |           |                                                                             | C | controller       |
|                 |           |                                                                             | D | drive            |
|                 |           |                                                                             |   |                  |

|                 |           |                                                                                                                               |   |                    |
|-----------------|-----------|-------------------------------------------------------------------------------------------------------------------------------|---|--------------------|
| <b>Question</b> | <b>26</b> | The number of moveable joints in the base, the arm, and the end effectors of the robot determines_____                        | A | flexibility        |
|                 |           |                                                                                                                               | B | payload capacity   |
|                 |           |                                                                                                                               | C | operational limits |
|                 |           |                                                                                                                               | D | degrees of freedom |
|                 |           |                                                                                                                               |   |                    |
| <b>Question</b> | <b>27</b> | For a robot unit to be considered a functional industrial robot, typically, how many degrees of freedom would the robot have? | A | three              |
|                 |           |                                                                                                                               | B | four               |
|                 |           |                                                                                                                               | C | six                |
|                 |           |                                                                                                                               | D | eight              |
|                 |           |                                                                                                                               |   |                    |

|                 |           |                                                                                                                                              |   |              |
|-----------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------|---|--------------|
| <b>Question</b> | <b>28</b> | Which of the basic parts of a robot unit would include the computer circuitry that could be programmed to determine what the robot would do? | A | sensor       |
|                 |           |                                                                                                                                              | B | controller   |
|                 |           |                                                                                                                                              | C | arm          |
|                 |           |                                                                                                                                              | D | end effector |
|                 |           |                                                                                                                                              |   |              |
| <b>Question</b> | <b>29</b> | The collaborative robot arms are designed to mimic the range of motion of a _____                                                            | A | Network      |
|                 |           |                                                                                                                                              | B | Machine arm  |
|                 |           |                                                                                                                                              | C | Device       |
|                 |           |                                                                                                                                              | D | Human arm    |
|                 |           |                                                                                                                                              |   |              |

|                 |           |                                                                              |   |                      |
|-----------------|-----------|------------------------------------------------------------------------------|---|----------------------|
| <b>Question</b> | <b>30</b> | Which of the following terms refers to the rotational motion of a robot arm? | A | swivel               |
|                 |           |                                                                              | B | axle                 |
|                 |           |                                                                              | C | retrograde           |
|                 |           |                                                                              | D | roll                 |
|                 |           |                                                                              |   |                      |
| <b>Question</b> | <b>31</b> | First step in validating a test is to                                        | A | analyze the job      |
|                 |           |                                                                              | B | choose the tests     |
|                 |           |                                                                              | C | administer the tests |
|                 |           |                                                                              | D | Relate test scores   |
|                 |           |                                                                              |   |                      |

|                 |           |                                                                                                        |   |            |
|-----------------|-----------|--------------------------------------------------------------------------------------------------------|---|------------|
| <b>Question</b> | <b>32</b> | A test's validity can be demonstrated in                                                               | A | Two ways   |
|                 |           |                                                                                                        | B | Three ways |
|                 |           |                                                                                                        | C | Four ways  |
|                 |           |                                                                                                        | D | Five ways  |
|                 |           |                                                                                                        |   |            |
| <b>Question</b> | <b>33</b> | The problem that threatens the success of a project but which has not yet happened is called as _____. | A | Bug        |
|                 |           |                                                                                                        | B | Error      |
|                 |           |                                                                                                        | C | Risk       |
|                 |           |                                                                                                        | D | Defect     |
|                 |           |                                                                                                        |   |            |

|                 |           |                                                           |   |                                                                 |
|-----------------|-----------|-----------------------------------------------------------|---|-----------------------------------------------------------------|
| <b>Question</b> | <b>34</b> | When should Regression Testing to be performed?           | A | When the project manager says                                   |
|                 |           |                                                           | B | After the software has changed.                                 |
|                 |           |                                                           | C | Whenever software testing team get the time.                    |
|                 |           |                                                           | D | None of the above.                                              |
|                 |           |                                                           |   |                                                                 |
| <b>Question</b> | <b>35</b> | Which of the following are objective of software testing? | A | Determines that software product satisfy specified requirements |
|                 |           |                                                           | B | Demonstrate that software products are fit for use              |
|                 |           |                                                           | C | Detect defects                                                  |
|                 |           |                                                           | D | All the above                                                   |
|                 |           |                                                           |   |                                                                 |

|                 |           |                                                                                                                  |   |                                                |
|-----------------|-----------|------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------|
| <b>Question</b> | <b>36</b> | Which of the following terms refers to the use of compressed gasses to drive (power) the robot device?           | A | Photosensitive                                 |
|                 |           |                                                                                                                  | B | hydraulic                                      |
|                 |           |                                                                                                                  | C | piezoelectric                                  |
|                 |           |                                                                                                                  | D | pneumatic                                      |
|                 |           |                                                                                                                  |   |                                                |
| <b>Question</b> | <b>37</b> | With regard to the physics of power systems used operate robots, which statement or statements are most correct? | A | hydraulics involves the compression of liquids |
|                 |           |                                                                                                                  | B | hydraulics involves the compression of air     |
|                 |           |                                                                                                                  | C | pneumatics involves the compression of air     |
|                 |           |                                                                                                                  | D | chemical batteries produce AC power            |
|                 |           |                                                                                                                  |   |                                                |

|                 |           |                                                                                                        |   |                                                 |
|-----------------|-----------|--------------------------------------------------------------------------------------------------------|---|-------------------------------------------------|
| <b>Question</b> | <b>38</b> | Which of the following IS NOT one of the advantages associated with a robotics implementation program? | A | Low costs for hardware and software             |
|                 |           |                                                                                                        | B | Robots work continuously around the clock       |
|                 |           |                                                                                                        | C | Quality of manufactured goods can be improved   |
|                 |           |                                                                                                        | D | Reduced company cost for worker fringe benefits |
|                 |           |                                                                                                        |   |                                                 |
| <b>Question</b> | <b>39</b> | Under the OSH Act, employers are responsible for providing a _____                                     | A | Safe workplace                                  |
|                 |           |                                                                                                        | B | b) Land                                         |
|                 |           |                                                                                                        | C | c) Insurance                                    |
|                 |           |                                                                                                        | D | d) Estimation                                   |
|                 |           |                                                                                                        |   |                                                 |

|                 |           |                                                                                    |   |                             |
|-----------------|-----------|------------------------------------------------------------------------------------|---|-----------------------------|
| <b>Question</b> | <b>40</b> | Which of the following places would be LEAST likely to include operational robots? | A | warehouse                   |
|                 |           |                                                                                    | B | factory                     |
|                 |           |                                                                                    | C | hospitals                   |
|                 |           |                                                                                    | D | private homes               |
|                 |           |                                                                                    |   |                             |
| <b>Question</b> | <b>41</b> | What are the common security threats?                                              | A | File Shredding              |
|                 |           |                                                                                    | B | File sharing and permission |
|                 |           |                                                                                    | C | File corrupting             |
|                 |           |                                                                                    | D | File integrity              |
|                 |           |                                                                                    |   |                             |

|                 |           |                                              |   |                                                     |
|-----------------|-----------|----------------------------------------------|---|-----------------------------------------------------|
| <b>Question</b> | <b>42</b> | Which of the following is a good practice?   | A | Give full permission for remote transferring        |
|                 |           |                                              | B | Grant read only permission                          |
|                 |           |                                              | C | Grant limited permission to specified account       |
|                 |           |                                              | D | Give both read and write permission but not execute |
|                 |           |                                              |   |                                                     |
| <b>Question</b> | <b>43</b> | Which of the following is a strong password? | A | 19thAugust88                                        |
|                 |           |                                              | B | Delhi88                                             |
|                 |           |                                              | C | P@assw0rd                                           |
|                 |           |                                              | D | !augustdelhi                                        |
|                 |           |                                              |   |                                                     |

|                 |           |                                                                                                                               |   |                         |
|-----------------|-----------|-------------------------------------------------------------------------------------------------------------------------------|---|-------------------------|
| <b>Question</b> | <b>44</b> | If a robot can alter its own trajectory in response to external conditions, it is considered to be _____                      | A | intelligent             |
|                 |           |                                                                                                                               | B | mobile                  |
|                 |           |                                                                                                                               | C | open loop               |
|                 |           |                                                                                                                               | D | non-servo               |
|                 |           |                                                                                                                               |   |                         |
| <b>Question</b> | <b>45</b> | _____ refers to a different set of tasks ensures that the software that has been built is traceable to Customer Requirements. | A | Verification            |
|                 |           |                                                                                                                               | B | Requirement engineering |
|                 |           |                                                                                                                               | C | Validation              |
|                 |           |                                                                                                                               | D | None of the above       |
|                 |           |                                                                                                                               |   |                         |

|                 |           |                                                                                                      |   |                                                                        |
|-----------------|-----------|------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------|
| <b>Question</b> | <b>46</b> | _____ verifies that all elements mesh properly and overall system functions/performance is achieved. | A | Integration testing                                                    |
|                 |           |                                                                                                      | B | Validation testing                                                     |
|                 |           |                                                                                                      | C | Unit testing                                                           |
|                 |           |                                                                                                      | D | System Testing                                                         |
|                 |           |                                                                                                      |   |                                                                        |
| <b>Question</b> | <b>47</b> | What do you verify in White Box Testing?                                                             | A | Testing of each statement, object and function on an individual basis. |
|                 |           |                                                                                                      | B | Expected output.                                                       |
|                 |           |                                                                                                      | C | The flow of specific inputs through the code.                          |
|                 |           |                                                                                                      | D | All of the above.                                                      |
|                 |           |                                                                                                      |   |                                                                        |

|                 |           |                                                                                       |   |                    |
|-----------------|-----------|---------------------------------------------------------------------------------------|---|--------------------|
| <b>Question</b> | <b>48</b> | Who performs the Acceptance Testing while running the application of robot?           | A | Software Developer |
|                 |           |                                                                                       | B | End users          |
|                 |           |                                                                                       | C | Testing team       |
|                 |           |                                                                                       | D | Systems engineers  |
|                 |           |                                                                                       |   |                    |
| <b>Question</b> | <b>49</b> | Before handing over the software to the client, which testing is to be done in-house? | A | Alpha              |
|                 |           |                                                                                       | B | Beta               |
|                 |           |                                                                                       | C | Gamma              |
|                 |           |                                                                                       | D | Theta              |
|                 |           |                                                                                       |   |                    |

|                 |           |                                                                                                        |   |                                  |
|-----------------|-----------|--------------------------------------------------------------------------------------------------------|---|----------------------------------|
| <b>Question</b> | <b>50</b> | Applications such as robotics, expert systems, pattern recognition, artificial neural networks etc are | A | engineering software             |
|                 |           |                                                                                                        | B | artificial Intelligence software |
|                 |           |                                                                                                        | C | system software                  |
|                 |           |                                                                                                        | D | product line software            |
|                 |           |                                                                                                        |   |                                  |

