

**National Vocational and Technical Training Commission  
(NAVTTTC)**

**Competency Standards**

**For**

**“Mechatronics Technician“**

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## **Introduction**

The National Competency Standards are written specifications of skill and knowledge competencies required in a particular trade. The competency standards are developed by a group of practitioners supported by the TVET Reform Support Program in collaboration with National Vocational & Technical Training Commission (NAVTTTC).

Industry experts from the relevant industries from different geographical locations across Pakistan have participated in the development process of this competency standard to ensure input and ownership of all the stakeholders. NAVTTTC approves this competency standard on the recommendation of Industry Advisory Group (IAG) for the Services sector.

The National Competency Standards shall be used as a referral document for the development of curricula to be used in Technical and Vocational Education and Training.

## Structure of Competency Standard

<b>Structure of the competency standard table</b>	Competency Standards are performance specifications that identify the knowledge and competencies an individual needs to succeed in the workplace.
<b>Unit of competency</b>	A unit of competency is a statement which points to an outcome that employers will value and is observable and assessable during the work. The competency unit is derived during the process of occupational Analysis and is called 'Task Statement' in the job analysis table called competency map (DACUM Chart).
<b>Overview</b>	An overview is a description of the competency standard. It briefly describes the purpose and linkage of the competency units with a job role.
<b>Performance Criteria</b>	Performance criteria statements set the standard of performance of a task in a job role. It describes 'how well' a task or competency unit is to be performed. It should be observable and written in a measurable term. It is one of the basic criteria for conducting assessment of the performance of a skill worker
<b>Knowledge and Understanding</b>	Supporting knowledge and understanding statements include the essential knowledge and understanding, covering facts, principles, procedures, processes and methods. These statements cover the basic knowledge and understanding that is required to master a competency unit in an occupation.
<b>Tools and Equipment</b>	All the related tools, equipment and machinery that are required to perform a particular competency unit or task are listed under this heading.

### 1.

<b>Competency map</b>					
<b>A- Maintain Electrical system</b>					
<b>A-1 Maintain electrical system installation</b>	<b>A-2 Maintain electrical wiring system</b>	<b>A-3 Maintain electric equipment</b>	<b>A-4 Maintain switch gears</b>	<b>A-5 Diagnose faults in electrical system</b>	<b>A-6 Repair electrical system</b>
<b>B- Maintain hydraulic system</b>					

<b>B-1 Perform hydraulic system tests</b>	<b>B-2 Verify Hydraulic system parameters</b>	<b>B-3 Maintain fluid parameters</b>	<b>B-4 Maintain energy flow</b>	<b>B-5 Diagnose fault in hydraulic system</b>	<b>B-6 Replace equipment in hydraulic system</b>
<b>B-7 Repair hydraulic system</b>					
<b>C- Maintain Pneumatic system</b>					
<b>C-1 Perform pneumatic system tests</b>	<b>C-2 Verify Pneumatic system parameters</b>	<b>C-3 Verify Pneumatic system temperature</b>	<b>C-4 Diagnose fault in Pneumatic system</b>	<b>C-5 Replace equipment</b>	<b>C-6 Repair pneumatic system</b>
<b>D- Maintain PLC system</b>					
<b>D-1 Apply tug out on PLC system</b>	<b>D-2 Clean attachments in PLC system</b>	<b>D-3 Test I/O modules</b>	<b>D-4 Test performance of sensor</b>	<b>D-5 Perform PLC Test</b>	<b>D-6 Maintain CPU temperature</b>
<b>D-7 Replace PLC hardware</b>	<b>D-8 Diagnose faults in PLC system</b>	<b>D-9 Replace part in PLC system</b>	<b>D-10 Install application software</b>		
<b>E- Install mechatronics system</b>					
<b>E-1 Install system wiring</b>	<b>E-2 Install electrical devices</b>	<b>E-3 Install piping system</b>	<b>E-4 Install Mechanical system</b>	<b>E-5 Install hydraulic equipment</b>	<b>E-6 Install pneumatic equipment</b>
<b>E-7 Install electronics equipment system</b>	<b>E-8 insert sensors in system</b>	<b>E-9 Install functional correlation in system</b>	<b>E-10 Perform system calibration</b>	<b>E-11 Test off load system performance</b>	<b>E-12 Test full load system performance</b>
<b>F- Perform Preventive maintenance</b>					
<b>F-1 Follow equipment maintenance plan</b>	<b>F-2 Shut down mechatronics system</b>	<b>F-3 Perform indoor clean-ups</b>	<b>F-4 Perform Lubrication in system</b>	<b>F-5 Inspect safety installation</b>	<b>F-6 Inspect firefighting installations</b>
<b>F-7 Service Electrical devices</b>	<b>F-8 Service piping system</b>	<b>F-9 Service pneumatic equipment system</b>	<b>F-10 Service hydraulic equipment</b>	<b>F-11 Service Electronics equipment</b>	<b>F-12 Start up system after PM.</b>
<b>G- Perform Communication</b>					
<b>G-1 Practice active listening</b>	<b>G-2 Ask appropriate questions</b>	<b>G-3 Demonstrate telephone etiquette</b>	<b>G-4 Instruct labors</b>	<b>G-5 Communicate with supervisor</b>	<b>G-6 Maintain relations with Parts dealers</b>

<b><i>H- Pursue Professional Development</i></b>					
<b>H-1 Attend Training program</b>	<b>H-2 Consult experts colleagues</b>	<b>H-3 Visit trade exhibitions</b>	<b>H-4 Join trade associations</b>	<b>H-5 Interpret Mechatronics publications</b>	<b>H-6 Documentwork performed</b>
<b>H-7 Browse internet</b>					
<b><i>I- Demonstrate safety</i></b>					
<b>I-1 Adopt personal safety</b>	<b>I-2 Adopt equipment safety</b>	<b>I-3 Demonstrate safety against biohazards</b>	<b>I-4 Demonstrate mechanical shop safety</b>	<b>I-5 Demonstrate electrical shop safety</b>	<b>I-6 Demonstrate First aid application</b>

## **Module A: *Maintain Electrical system***

**Overview:** This competency standard refers to the development of skills and competences on Mechatronics related electrical system maintenance. It also deals with basic electrical

wiring, trouble shooting in the system, identification and handling of tools and equipment to perform electrical maintenance.

<b>Competency Unit</b>	<b>Performance Criteria</b>	<b>Knowledge and Understanding</b>
<p><b>A-1 Maintain electrical system installation</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Handle electrical hand and power tools correctly</b></p> <p><b>P-2 Operate electrical test and measuring instrument according to SOPs</b></p> <p><b>P-3 Maintain tools test and measuring instrument for proper working / operation</b></p> <p><b>P-4 Diagnose fault in electrical system according to the recommended steps/ method prescribed in service manuals instructions</b></p> <p><b>P-5 Remove Faulty Unit from electrical system implementing necessary safety measures</b></p> <p><b>P-6 Replace units in electrical system considering their compatibility</b></p>	<p><b>A competent individual must be able to successfully :</b></p> <p><b>K-1 Interpret electrical drawing / manual</b></p> <p><b>K-2 Describe electrical quantities</b></p> <p><b>K-3 Differentiate Alternating and direct current</b></p> <p><b>K-4 Identify electrical tools</b></p> <p><b>K-5 Use test and measuring instrument</b></p> <p><b>K-6 Calculate electrical quantities in circuits</b></p> <p><b>K-7 Interpret electrical component specifications</b></p> <p><b>K-8 Describe necessity of earthing system</b></p> <p><b>K-9 State characteristics of semi-conductor components and circuits</b></p> <p><b>K-10 Identify current path in D.C power supplies</b></p> <p><b>K-11 State characteristics of analogue and digital electronic circuits</b></p>

<p><b>A-2 Maintain electrical wiring system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Terminate electrical wiring as per SOPs</b></p> <p><b>P-2 Connect wires and cables according to the diagram</b></p> <p><b>P-3 Maintain installed cables / conductors / conduit / enclosures and supports of electrical systems as per SOPs</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Identify parts of electrical installation</b></p> <p><b>K-2 Calculate cable resistance and current carrying capacity</b></p> <p><b>K-3 Enlist types of electrical joints</b></p> <p><b>K-4 Describe single and three phase electrical power distribution systems</b></p> <p><b>K-5 State trouble shooting methods in electrical wiring</b></p> <p><b>K-6 State power losses in electrical circuit</b></p>
<p><b>A-3 Maintain electric equipment</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Test efficiency of electrical load if it is within prescribed tolerance</b></p> <p><b>P-2 Diagnose fault in electrical equipment following service manuals instructions</b></p> <p><b>P-3 Remove Fault from electrical equipment adopting safety measures</b></p> <p><b>P-4 Replace motors in electrical system considering compatibility</b></p> <p><b>P-5 Replace D.C Power source /supply in the system considering compatibility</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define working principle of A.C machines used in process industry</b></p> <p><b>K-2 Describe construction of A.C/D.C/ Servo and Stepper Motors machine used in process industry</b></p> <p><b>K-3 Calculate speed and efficiency of electric motors</b></p> <p><b>K-4 Interpret motor characteristics chart / curve</b></p>
<p><b>A-4 Maintain switch gears</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Perform cold test on fuse, circuit breaker, contractor, switch and relay for normal working</b></p> <p><b>P-2 Perform Live test on fuse, circuit breaker, contractor, switch and relay for normal working</b></p> <p><b>P-3 Replace switchgears in mechatronics electrical installation considering their compatibility</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe principles electro magnetism</b></p> <p><b>K-2 Enlist electrical switch gears</b></p> <p><b>K-3 interpret data on electrical switch gear</b></p>



<p><b>A-5 Diagnose faults in electrical system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Verify penal wiring for normal operation</b></p> <p><b>P-2Diagnose electrical fault in mechatronics electrical installation using prescribed diagnostic methods</b></p> <p><b>P-3 Diagnose mechanical fault in electrical installation of mechatronics system using prescribed diagnostic methods</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define Electrical penal</b></p> <p><b>K-2 Describe the basis for testing the function of electrical equipment in electrical system</b></p> <p><b>K-3 Enumerate trouble shooting method in mechatronics electrical system</b></p> <p><b>K-4 Describe diagnostic tools and equipment</b></p> <p><b>K-5 Describe integrated fault diagnostic system</b></p>
<p><b>A-6 Repair electrical system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Verify Electrical Panels for proper working</b></p> <p><b>P-2 Perform diagnosis tests in electrical system for fault diagnose in the system implementing prescribed methods in system manual</b></p> <p><b>P-3 Rectify the trouble in electrical systemfor normal operation</b></p> <p><b>P-4 Test electrical system performance after repairing for normal operation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist common faults in electrical system</b></p> <p><b>K-2 Describe Trouble shooting techniques in electrical circuits</b></p>

## Module B: Maintain Hydraulic System

**Overview:** This competency standard refers to the development of skills and competences on Hydraulic system maintenance. It also deals with basic Hydraulic concepts, Tests performance and verification of system, maintenance of energy flow and repairing of hydraulic system installed in process industry.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>B-1 Perform hydraulic system tests</b>	<p><b>A competent individual must be able to:</b></p> <p>P-1 Verify hydraulic cylinder performance for normal working</p> <p>P-2 Test filters performance for clogging</p> <p>P-3 Verify performance of hydraulic gauges and Valves for normal working</p> <p>P-4 Verify performance of hydraulic Pumps for normal working</p>	<p><b>A competent individual must be able to successfully:</b></p> <p>K-1 Interpret hydraulic drawing / manual</p> <p>K-2 Define units in hydraulics, Hydrostatics, hydrodynamics, Fluids and Viscosity</p> <p>K-3 State static and dynamic characteristics of instruments</p> <p>K-4 Calculate fluid pressure in hydraulic system</p> <p>K-5 Draw hydraulic cycle</p> <p>K-6 Describe Fluid parameters</p> <p>K-7 Explain working of industrial hydraulic system parts</p> <p>K-8 Classify hydraulic systems</p> <p>K-9 Identify fluid control components</p> <p>K-10 Describe the purpose of fluid conductors</p> <p>K-11 Describe the property of carbon compound and hydrocarbon.</p>
<b>B-2 Verify Hydraulic system parameters</b>	<p><b>A competent individual must be able to:</b></p> <p>P-1 Verify Regulators for proper working</p> <p>P-2 Verify Fluid Reservoir for proper working.</p> <p>P-3 Verify Pressure gauges for proper working</p>	<p><b>A competent individual must be able to successfully:</b></p> <p>K-1 Describe Hydraulic system components</p> <p>K-2 Illustrate Working of hydraulic components.</p> <p>K-3 Describe working of hydraulic components</p>

<p><b>B-3 Maintain fluid parameters</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Verify Fluid validity for normal working conditions</b></p> <p><b>P-2 Verify fluid gravity for normal working conditions</b></p> <p><b>P-3 Maintain Fluid Viscosity/density /pressure / temperature for normal system operation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define Core Concepts of fluid Parameters</b></p> <p><b>K-2 Explain basic Equations of fluid behaviour.</b></p> <p><b>K-3 Define flow types.</b></p> <p><b>K-4 Define characteristics of the hydraulic oils.</b></p> <p><b>K-5 Interpret hydraulic circuit drawings.</b></p>
<p><b>B-4 Maintain energy flow</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Keep energy flow losses within predetermined tolerance</b></p> <p><b>P-2 Verify Sensors performance according to their sensing limitations</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Explain force transmission in hydraulic system.</b></p> <p><b>K-2 Define thermal properties of mater</b></p> <p><b>K-3 Explain working of instrument used in energy flow system</b></p> <p><b>K-4 Explain Working of Filters</b></p> <p><b>K-5 Define Functions of hydraulic Sensors</b></p>
<p><b>B-5 Diagnose fault in hydraulicsystem</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Rectify fluid leakage from Hydraulic system implementing prescribed fluid leakage checking methods</b></p> <p><b>P-2 Diagnose faulty equipment/part in hydraulic system conductors implementing prescribed methods in system manual</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define faults Procedures in hydraulic System</b></p> <p><b>K-2 State principals of energy conversion</b></p> <p><b>K-3 Enlist components of hydraulic circuit with their applications.</b></p> <p><b>K-4 Describe the operation and performance of equipment in hydraulic circuit</b></p>
<p><b>B-6 Replace equipment in hydraulic system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Remove Faulty equipment from hydraulic system implementing prescribed methods in system manual</b></p> <p><b>P-2 Replace correct equipment in hydraulic system implementing prescribed methods in system manual</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe replacing procedure of faulty part in hydraulicsystem</b></p>

<p><b>B-7 Repair hydraulic system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Implement techniques to repair equipment of hydraulic system prescribed in system manual</b></p> <p><b>P-2 Verify hydraulic system parameters implementing prescribed methods in system manual</b></p> <p><b>P-3 Repair equipment of hydraulic circuit implementing prescribed methods in system manual</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Knowledge about repairing specialities.</b></p>
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## Module C: Maintain pneumatic system

**Overview:** This competency standard refers to the development of skills and competences on Pneumatic system maintenance in process industry. It also deals with basic Pneumatic concepts, Test performed and verification of system. Maintenance of temperature & Perform repairing in pneumatic system,

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>C-1 Perform pneumatic system tests</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Apply desired pneumatic pressure as per system requirement</b></p> <p><b>P-2 Verify pneumatic cylinder performance for normal operation</b></p> <p><b>P-3 Test filters performance for clogging</b></p> <p><b>P-4 Verify performance of gauges performance for normal operation</b></p> <p><b>P-5 Verify performance of pneumatic Pumps performance for normal operation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Interpret Pneumatic drawing / manual</b></p> <p><b>K-2 Define physical properties of air</b></p> <p><b>K-3 Describe Volume and pressure in pneumatic system</b></p> <p><b>K-4 Relate Pressure , Volume and temperature in Gases</b></p> <p><b>K-5 Describe working of air compressor</b></p> <p><b>K-6 Enlist equipment of a typical pneumatic system</b></p> <p><b>K-7 Describe working of pneumatic equipment</b></p> <p><b>K-8 Describe the method of compress air Preparation</b></p> <p><b>K-9 Describe the production method and application of compressed air and vacuum</b></p>
<b>C-2 Verify Pneumatic system parameters</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-2 Verify performance of pneumatic system performance for normal operation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe the method of pneumatic system performance test</b></p>
<b>C-3 Verify Pneumatic system temperature</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 verify physical condition of pneumatic system performance for normal operation</b></p> <p><b>P-2 Test compressing equipment parameter implementing recommended</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe the method of parameter testing in pneumatic system</b></p>

	<p>testing methods</p> <p><b>P-3 Adjust equipment controls for desired parameters</b></p>	<p><b>K-2 Define adjustment process of pneumatic system</b></p>
<p><b>C-4 Diagnose fault in Pneumatic system</b></p>	<p>A competent individual must be able to:</p> <p><b>P-1 Determine air leakage in pneumatic system implementing leakage testing methods</b></p> <p><b>P-2 Verify Pneumatic equipment performance for normal operation</b></p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1 Describe Method of leakage diagnostic in pneumatic</b></p> <p><b>K-2 State the procedure of rectify leakage of process</b></p>
<p><b>C-5 Replace equipment</b></p>	<p>The Technician will be able to:</p> <p><b>P-1 Remove desired equipment from Pneumatic system</b></p> <p><b>P-2 Mount equipment in Pneumatic system</b></p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1 Describe method of equipment removal from pneumatic system</b></p> <p><b>K-2 Describe method of equipment insertion pneumatic system</b></p>
<p><b>C-6 Repair pneumatic system</b></p>	<p>A competent individual must be able to:</p> <p><b>P-1 Diagnose cause/s of leakage in the system</b></p> <p><b>P-2 Replace faulty equipment in pneumatic system implementing recommended testing methods</b></p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1 Enlist typical causes of leakage in pneumatic system</b></p> <p><b>K-2 Describe method of leakage detection in pneumatic system</b></p>

## Module D: Maintain PLC system

**Overview:** This competency standard refers to the development of skills and competences on PLC system maintenance in process industry. It also deals with basic concepts of PLC, basics of programming, testing performance & verification of PLC system and performing PLC repair and maintenance.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>D-1 Apply tug out on PLC system</b>	<p>A competent individual must be able to:</p> <p>P-1 Recognise PLC wires and cables according to schematic/ wiring diagrams</p> <p>P-2 Set manual switches for desired operation</p> <p>P-3 Tug out PLC from the system implementing recommended tugging out methods</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Interpret PLC drawing / manual</p> <p>K-2 Describe operation of PLC</p> <p>K-3 Interpret TTL/CMOS IC manual</p> <p>K-4 Determine ladder logic</p> <p>K-5 Draw PLC wires and cable memorandum</p>
<b>D-2 Clean attachments in PLC system</b>	<p>A competent individual must be able to:</p> <p>P-1 Maintain dust free environment around PLC as per SOPs</p> <p>P-1 Perform cleaning on PLC implementing SOPs</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Enlist PLC Cleaning agents</p>
<b>D-3 Test I/O modules</b>	<p>A competent individual must be able to:</p> <p>P-1 Perform network data communication</p> <p>P-2 Verify I/O Modules for normal operation</p> <p>P-1 Verify CPU of PLC for normal operation</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Interpret Ladder logic diagram</p> <p>K-2 Recognise PLC Logic</p> <p>K-3 Define I/O logic method</p> <p>K-4 Design simple program to test on line PLC Performance</p>
<b>D-4 Test performance of sensor</b>	<p>A competent individual must be able to:</p> <p>P-1 Verify Sensors for normal performance</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe the working of Sensors used in mechatronics</p>
<b>D-5 Perform PLC Test</b>	<p>A competent individual must be able to:</p> <p>P-1 Attach computer with PLC</p> <p>P-2 Perform Manual operation test</p> <p>P-2 Configure PLC operation for designed program</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe PLC Testing Procedure</p>

<p><b>D-6 Maintain CPU temperature</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Verify PLC temperature for prescribed limits</b></p> <p><b>P-2 Apply measures to keep the temperature within limits</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Convert Temperature scale from one into other</b></p> <p><b>K-2 Enumerate reasons for PLC over heating</b></p> <p><b>K-3 Enlist parts used to keep the temperature of PLC under control</b></p>
<p><b>D-7 Replace PLC hardware</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Diagnose Hardware trouble in PLC</b></p> <p><b>P-2 Remove faulty part from PLC unit</b></p> <p><b>P-3 Replace Part/s in PLC</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Interpret PLC Manual</b></p>
<p><b>D-8 Diagnose faults in PLC system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Verify I/O Modules for optimum performance</b></p> <p><b>P-2 Determine malfunctioning due to ladder logic program</b></p> <p><b>P-3 Diagnose fault caused by the attached equipment</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enumerate fault diagnostic technique in PLC System</b></p>
<p><b>D-9 Replace part in PLC system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Remove Faulty equipment from the system</b></p> <p><b>P-2 Install desired equipment in the system</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define procedure of PLC dismantling</b></p>
<p><b>D-10 Install application software</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Format system software or error less software installation</b></p> <p><b>P-2 Perform software installation in mechatronics system for error less operation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Identify software desired for the system</b></p>



## Module E: Install Mechatronics system

**Overview:** This competency standard refers to the development of skills and competences on Mechatronics system Installation in industrial plant. It also deals with basic concepts, Testing and verification of the system, maintenance of energy flow and repair of hydraulic system installed in process industry.

Competency Unit	Performance Criteria	Knowledge and Understanding
<p><b>E-1 Install system wiring</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Layout of the Foundations of Electrical equipment according to blue print</b></p> <p><b>P-2 Perform basic sheet metal work according to prescribed tolerance given in blue print</b></p> <p><b>P-3 Install earthing system applying prescribed method of earth installation</b></p> <p><b>P-4 Install mechanical units of wiring applying prescribed method of installation</b></p> <p><b>P-5 Install Electrical Wiring applying prescribed method of installation</b></p> <p><b>P-6 Install electrical panel applying prescribed method of installation</b></p> <p><b>P-7 Commission electrical Wiring for desired operation</b></p> <p><b>P-8 Evaluate the whole procedure as per SOPs</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe mechatronics and its scope</b></p> <p><b>K-2 Enlist types of industries getting benefits from mechatronics</b></p> <p><b>K-3 Describe operation of mechanical systems.</b></p> <p><b>K-4 Interpret mechatronics system wiring diagram.</b></p> <p><b>K-5 Enlist material required to install electrical wiring</b></p>
<p><b>E-2 Install electrical devices</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Induct Electrical equipment in the mechatronics system applying prescribed method of equipment induction in the system</b></p> <p><b>P-2 Perform electrical sensors tests applying prescribed method of installation</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist material/devices required to install in mechatronics electrical system</b></p>

<p><b>E-3 Install piping system</b></p>	<p>A competent individual must be able to:</p> <p><b>P-1</b> Inspect Piping Material according to specifications</p> <p><b>P-2</b> Inspect fluid flow through piping as recommended in manual</p> <p><b>P-3</b> Install piping system for mechatronics system applying prescribed method of installation</p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1</b> Demonstrate knowledge about all piping Specification.</p> <p><b>K-2</b> Identify pipes by colour codes</p> <p><b>K-2</b> Identify different piping materials.</p> <p><b>K-3</b> Calculate pressure loss in pipes.</p> <p><b>K-4</b> Interpret Piping diagram</p>
<p><b>E-4 Install Mechanical system</b></p>	<p>A competent individual must be able to:</p> <p><b>P-1</b> Check floor level as per system requirements</p> <p><b>P-2</b> Install frame structure according to blue print.</p> <p><b>P-3</b> Lay foundations of mechanical equipment according to blue print</p> <p><b>P-4</b> Determine suitability of existing supports, brackets, clamps, adapters, etc. for proper load bearing</p> <p><b>P-5</b> Induct mechanical parts in the system applying prescribed method of parts induction</p> <p><b>P-6</b> Erect mechanical machinery as per manual</p> <p><b>P-7</b> Commission mechanical Systems for desired operation</p> <p><b>P-8</b> Verify operation of mechanical systems according to SOPs</p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1</b> Interpret the P&amp;ID.</p> <p><b>K-2</b> Enlist Parts of hydraulic system</p> <p><b>K-3</b> Describe interpreting P&amp;ID.</p> <p><b>K-4</b> Distinguish B/w oil grades of hydraulic system</p> <p><b>K-5</b> Define importance of sealing in hydraulic system</p> <p><b>K-6</b> Enlist sealing parts/materials</p> <p><b>K-7</b> Describe the Procedures for erecting.</p> <p><b>K-8</b> Describe procedures for Commissioning.</p> <p><b>K-9</b> Describe the operating principals of heat generator, heat exchanger, Pumps, turbine and valves</p> <p><b>K-10</b> State the operation of coupling between drives and machines of mechatronics system</p>
<p><b>E-5 Install hydraulic equipment</b></p>	<p>A competent individual must be able to:</p> <p><b>P-1</b> Install hydraulic Pump applying prescribed method of installation</p> <p><b>P-2</b> Install hydraulic gauge applying prescribed method of installation</p> <p><b>P-3</b> Maintain recommended oil level in hydraulic system up to normal limits</p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1</b> Enlist Hydraulic equipment installation steps</p> <p><b>K-2</b> Describe importance of oil level maintenance in hydraulic system</p>

<p><b>E-6 Install pneumatic equipment</b></p>	<p>A competent individual must be able to:</p> <p>P-1 Install assorted valves applying prescribed method of installation</p> <p>P-2 Install filter regulator applying prescribed method of installation</p> <p>P-3 Install Speed controller applying prescribed method of installation</p> <p>P-4 Install cylinder applying prescribed method of installation</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Enlist Pneumatic system parts and equipment</p> <p>K-2 Identify Pneumatic system parts</p> <p>K-3 Describe operation of Ball valve ,exhaust valve filter regulator, solenoid valve, speed controller and Cylinder</p>
<p><b>E-7 Install electronics equipment system</b></p>	<p>A competent individual must be able to:</p> <p>P-1 Connect electronics equipment in mechatronics system applying prescribed method of installation</p> <p>P-2 Install A.C Electronics drives in mechatronics system applying prescribed method of installation</p> <p>P-3 Install D.C electronics drives in mechatronics system applying prescribed method of installation</p> <p>P-4 Install display systems and indicators applying prescribed method of installation</p> <p>P-5 Install monitoring devices and alarm systems applying prescribed method of installation</p> <p>P-6 Install / replace distributed control systems (DCSs) applying prescribed method of installation</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Interpret electronic drawing / manual</p> <p>K-2 Analysis Digital components and circuits</p> <p>K-3 Draw block diagram for operation and flow chart of mechatronics equipment/drives</p>
<p><b>E-8 Insert sensors in system</b></p>	<p>A competent individual must be able to:</p> <p>P-1 Install sensing device in mechatronics system applying prescribed method of installation</p> <p>P-2 Install calibration equipment in mechatronics system applying prescribed method of installation</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Define the steps for performing system calibration</p>
<p><b>E-9 Install functional correlation in system</b></p>	<p>A competent individual must be able to:</p> <p>P-1 Design simple plant according to chemical engineering principal</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Identify plant sections</p> <p>K-2 Define step wise method of chemical process</p> <p>K-3 Define mechatronics sub</p>

		system
<b>E-10 Perform system calibration</b>	<p>A competent individual must be able to:</p> <p>P-1 Calibrate Mechatronics system to desired parameters recommended in the service manual</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe Common parameters used on process plant</p>
<b>E-11 Test off load system performance</b>	<p>A competent individual must be able to:</p> <p>P-1 Perform offload electrical system tests recommended in the service manual</p> <p>P-2 Perform off load pneumatic system tests recommended in the service manual</p> <p>P-3 Perform off load hydraulic tests recommended in the service manual</p> <p>P-4 Perform off load electronics systems tests recommended in the service manual</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 State the sequence of commissioning of mechatronics equipment</p> <p>K-2 Describe the use of calibrator</p> <p>K-3 Enlist procedural steps for off load Electrical Tests</p> <p>K-4 Enlist procedural steps for off load Pneumatic system tests</p> <p>K-5 Enlist procedural steps for off load Hydraulic system tests</p> <p>K-6 Enlist procedural steps for off load electronics system tests</p>
<b>E-13 Test full load system performance</b>	<p>A competent individual must be able to:</p> <p>P-1 Perform offload electrical system tests recommended in the service manual</p> <p>P-2 Perform off load pneumatic system tests recommended in the service manual</p> <p>P-3 Perform off load hydraulic tests recommended in the service manual</p> <p>P-4 Perform off load electronics systems tests recommended in the service manual</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Follow safety guidelines for system commissioning</p> <p>K-2 Enlist procedural steps for off load Electrical Tests</p> <p>K-3 Enlist procedural steps for off load pneumatic system Tests</p> <p>K-4 Enlist procedural steps for off load Hydraulic system tests</p> <p>K-5 Enlist procedural steps for off load electronics system Tests</p> <p>K-6 State the cause &amp; effects of overloaded conditions</p>

## Module F: Perform Preventive Maintenance

**Overview:** This competency standard refers to the development of skills and competences on preventive maintenance of Mechatronics system. It also deals with basic concepts of maintenance scheduling, indoor clean-ups, shutting the system off and turning it on, verification, service assorted equipment and repair minor faults of the system.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>F-1 Follow system maintenance plan</b>	<p>A competent individual must be able to:</p> <p>P-1 Inform concerned Department accordingly</p> <p>P-2 Follow Maintenance scheme accordingly</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Interpret maintenance flow charts</p> <p>K-2 Define the influence of process and changing operating conditions</p>
<b>F-2 Shut down mechatronics system</b>	<p>A competent individual must be able to:</p> <p>P-1 Get shutting down approval from authority</p> <p>P-2 Shut down Electrical system, applying SOP</p> <p>P-3 Perform physical system verification correctly</p> <p>P-4 Shut down the system following shutting down scheme</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe procedure of mechatronics system shutting down</p>
<b>F-3 Perform indoor clean-ups</b>	<p>A competent individual must be able to:</p> <p>P-1 Clean attachments / equipment / drives/ units / cable / pipes / mountings apply 5S methods</p> <p>P-2 perform surrounding area clean up as scheduled</p> <p>P-3 Dispose of waste applying SOPs</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Enlist 5S for industry</p>
<b>F-4 Perform Lubrication in system</b>	<p>A competent individual must be able to:</p> <p>P-1 Maintain lubricant log up to date</p> <p>P-2 Lubricate machine equipment as per SOPs</p> <p>P-3 Lubricate mechanical parts equipment as per SOPs</p> <p>P-4 Lubricate Hydraulic equipment as per SOPs</p> <p>P-5 Maintain Lubricant according to</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Interpret lubricant specifications</p> <p>K-2 Classify industrial lubricants</p>

	prescribed level	
<b>F-5 Inspect safety installation</b>	<p>A competent individual must be able to:</p> <p>P-1 Conduct Safety installation inspection compliance with control of Substances Hazardous to Health Regulations(COSHH)</p> <p>P-2 Document Safety inspection record up to date</p>	<p>A competent individual must be able to successfully :</p> <p>K-1 Identify potential hazards</p>
<b>F-6 Inspect fire fighting installations</b>	<p>A competent individual must be able to:</p> <p>P-1 Inspect fire fighting installation regularly</p> <p>P-2 Verify fire extinguishers for expiry</p> <p>P-3 Document fire fighting installation inspection record up to date</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe fire fighting methods</p> <p>K-2 Define working of smoke detector/fire alarms</p> <p>K-3 Describe the working of fire extinguishers</p> <p>K-4 Describe the working of fire fighting sprinkles</p>
<b>F-7 Service electrical devices</b>	<p>A competent individual must be able to:</p> <p>P-1 Service Power supply according to recommendation in service manual</p> <p>P-2 Service electrical equipment according to defined SOPs</p> <p>P-3 Service and maintain display systems and indicators according to recommendation in service manual</p> <p>P-4 Configure, calibrate and test display systems &amp; indicators according to recommendation in service manual</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Define Battery</p> <p>K-2 Describe Halfwave, full wave and bridge rectifier circuit</p> <p>K-3 Describe regulated power supply circuit</p> <p>K-4 Describe switch mode power supply circuit</p>
<b>F-8 Service piping system</b>	<p>A competent individual must be able to:</p> <p>P-1 Test piping system for Leakage/mechanical damages /loose fittings according to recommendation in service manual</p> <p>P-2 Remove Leakage/mechanical damages /loose fittings from piping system according to recommendation in service manual</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Enlist industrial pipe and fittings</p> <p>K-2 Enumerate causes of piping leakage</p>

<p><b>F-9 Service pneumatic equipment system</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Test pneumatic system for failure /mechanical damages /loose fittings according to recommendation in service manual</b></p> <p><b>P-2 Remove Leakage/mechanical damages /loose fittings from pneumatic system according to recommendation in service manual</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist Pneumatic parts and fittings</b></p> <p><b>K-2 Numerate causes of pneumatic system failure/leakage</b></p>
<p><b>F-10 Service hydraulic equipment</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Test hydraulic system for failure / mechanical damages /loose fittings according to recommendation in service manual</b></p> <p><b>P-2 Remove Leakage/mechanical damages /loose fittings from hydraulic system applying prescribed trouble shooting methods</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist hydraulic parts and fittings</b></p> <p><b>K-2 Numerate causes of hydraulic system failure/leakage</b></p>
<p><b>F-11 Service electronics equipment</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Test electronics equipment performance according to recommendation in service manual</b></p> <p><b>P-2 Remove faulty Electronics equipment/circuits from the mechatronics system according to SOPs</b></p> <p><b>P-3 Service and maintain monitoring devices &amp; alarm systems according to recommendation in service manual</b></p> <p><b>P-4 Service and maintain signal conversions and transmitters</b></p> <p><b>P-5 Service positioners according to recommendation in manual</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 State function of electronic circuits</b></p> <p><b>K-2 Differentiate between cold , hot and signal tests</b></p>
<p><b>F-12 Start up system after PM</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Check mechatronics system if it is ready for start up</b></p> <p><b>P-2 Get start up approval from authority</b></p> <p><b>P-3 Startup system applying SOPs</b></p> <p><b>P-4 Certify operation of the system according to SOPs</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist running system parameters</b></p>

## Module G: Perform Communication

**Overview:** This competency standard refers to the development of skills and competences to perform communication. It also deals with listening practice, adopting questioning technique to lead actual issues in the system, Demonstrating telephonic ethics and moral techniques to deal with people related to the work.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>G-1 Practice active listening</b>	<p>A competent individual must be able to:</p> <p>P-1 perform desired physical actions on verbal commands accordingly</p> <p>P-2 Determine communication styles elegantly</p> <p>P-3 Display body language while listening to a customer to show attention</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Concentrate on commands/speeches</p> <p>K-2 Demonstrate adeptness for Technical English</p>
<b>G-2 Ask appropriate questions</b>	<p>A competent individual must be able to:</p> <p>P-1 Investigate issue /problem through relevant questions</p> <p>P-2 Demonstrate courteous behaviour while listen to the people actively</p> <p>P-3 Record information about customer's enquiry or complaints as per company practice</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Make a fault questionnaire</p>
<b>G-3 Demonstrate telephone etiquette</b>	<p>A competent individual must be able to:</p> <p>P-1 Demonstrate courteous behaviour and listen actively to customer</p> <p>P-2 Perform phone conversation applying time management concisely</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Record information about enquiry or complaint as per company's practice</p>
<b>G-4 Instruct labor</b>	<p>A competent individual must be able to:</p> <p>P-1 Opt language for commending</p>	<p>A competent individual must be able to successfully:</p> <p>K-1 Describe the methods overcome the sentiment</p>



	<b>P-2 Use language which labour could understand elegantly</b>	
<b>G-5 Communicate with supervisor</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Convey ideas to the supervisor precisely</b></p> <p><b>P-2 Report safety hazards to supervisor urgently</b></p> <p><b>P-3 Maintain good working relation with supervisor elegantly</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe the Importance of accurate communication</b></p> <p><b>K-2 Write work reports</b></p> <p><b>K-3 Fill indent form</b></p> <p><b>K-4 Maintain work history</b></p>
<b>G-6 Maintain relations with Parts dealer</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Apply communication skills while dealing with shop owner/dealer elegantly</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Enlist names and address of trade related shops/agencies/traders/shops/dealers</b></p>

## Module H: Develop professionalism

Overview: This competency standard refers to the development of skills and competences to meet the ever changing market demands and challenges. The technician must evaluate his/her performance, attend capacity building programs and exhibit positive attitude towards attaining the organization's goals.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>H-1 Participate in plant Training program</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Attend at plant training regularly</b></p> <p><b>P-2 Participate in scheduled working plan meeting courteously</b></p> <p><b>P-3 Attend skill up gradation training/ seminars regularly</b></p> <p><b>P-4 Visit assorted industrial units regularly</b></p> <p><b>P-5 Participate in skill competitions regularly</b></p> <p><b>P-6 Demonstrate to-do attitude in profession elegantly</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Recognise the importance of Mechatronics technician in process and manufacturing industry</b></p> <p><b>K-2 Define technical regulations for process plant</b></p> <p><b>K-3 State the importance of teamwork</b></p> <p><b>K-4 State the principles of solid, semi-solid and liquid processing</b></p> <p><b>K-5 State the importance and application of electro chemical process</b></p>
<b>H-2 Consult experts colleagues</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Get technical advice from pro workers properly</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Collect plant structural data</b></p>
<b>H-3 Visit trade exhibitions</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Report information collected from trade exhibition visit concisely</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Recognise the purpose of visit</b></p>
<b>H-4 Join trade associations</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Upgrade professionalism by joining electrical , electronics and other related associations</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Identify the objectives of trade association</b></p>

<p><b>H-5 Interpret Mechatronics publications</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Apply skills mentions in Technical bulletins correctly</b></p> <p><b>P-2 Adopt skill up gradation suggested in books and websites</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe the core information from publication</b></p>
<p><b>H-6 Document work performed</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Perform error free documentation using MS Excel</b></p> <p><b>P-2 Write work reports on MS office concisely</b></p> <p><b>P-3 Document activity log on prescribed forms</b></p> <p><b>P-4 Insert data in excel work sheet</b></p> <p><b>P-5 produce hard copy of work done on computer in error free format</b></p> <p><b>P-6 Produce EST , ESN, LST diary up to date</b></p> <p><b>P-7 Produce basic Mechatronics drawing using AutoCAD</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe Ms office short keys</b></p> <p><b>K-2 Interpret log books, Manufacturer reports and other relevant documents.</b></p> <p><b>K-3 Define short keys for MS Excel</b></p> <p><b>K-4 Record the Basic lab. Documentation and plant data</b></p>
<p><b>H-7 Maintain performance record</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Produce KPI Record in order</b></p> <p><b>P-2 produce Machine history log book up to date</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Define ecological and economical aspects of the Mechatronics work</b></p>

	<p><b>P-3 Produce PM log book in order</b></p> <p><b>P-4 Produce spare tools/equipment/ consumable Inventory record in order</b></p> <p><b>P-5 Modify the schedule and charts of analytical instruments in order</b></p> <p><b>P-6 Maintain service documents in order</b></p>	
<p><b>H-8 Utilize internet</b></p>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1 Use error free language in writing letters/emails concisely</b></p> <p><b>P-2 Ensure format or structure of the correspondence is according to company's practice</b></p> <p><b>P-3 Browse website as per desire</b></p> <p><b>P-4 Download related software as per desire</b></p> <p><b>P-5 Perform accurate communication via internet with in specified time limits</b></p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1 Describe procedure of Creating E-mail account</b></p> <p><b>K-2 Describe procedure of sending E-mail</b></p> <p><b>K-3 Describe short keys for MS office</b></p>

## Module I: Demonstrate safety

Overview: The competency standard is about demonstrating skill and knowledge of personal health, safety, infrastructural safety, firefighting, first aid procedures, quality and environment related regulations in industrial workplace.

Competency Unit	Performance Criteria	Knowledge and Understanding
<b>I-1 Adopt personal safety</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1</b> Take corrective action against potential workplace health &amp; safety hazards applying OHSAS</p> <p><b>P-2</b> Utilize PPEs as per SOPs</p> <p><b>P-3</b> Handle and store hazardous workplace materials according to Prescribed handling instructions</p> <p><b>P-4</b> Comply with workplace legislation relating to health &amp; safety</p> <p><b>P-5</b> Maintain personal hygiene according to SOP</p> <p><b>P-6</b> Deal with environmental safety issues according to Industrial environmental regulations</p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-1</b> Enumerate Common industrial PPEs</p> <p><b>K-2</b> Describe safety precaution while working with electricity</p> <p><b>K-3</b> State the assets safety norms</p> <p><b>K-4</b> Describe key points of RCA evaluation and international accident prevention</p>
<b>I-2 Adopt equipment safety</b>	<p><b>A competent individual must be able to:</b></p> <p><b>P-1</b> Implement prescribed safety for equipment to keep the equipment in working conditions</p>	<p><b>A competent individual must be able to successfully:</b></p> <p><b>K-2</b> Enlist safety precaution while working with machine</p> <p><b>K-1</b> Interpret Safety rules written in equipment manual</p> <p><b>K-2</b> Enlist safety precaution during gas cylinder handling</p>
<b>I-3 Demonstrate safety against biohazards</b>	<p><b>A competent individual must be able to :</b></p> <p><b>P-1</b> Follow safety Instruction against bio hazard according to OHSAS</p> <p><b>P-2</b> Dispose of chemical waste according to SOPs</p>	<p><b>A competent individual must be able to successfully :</b></p> <p><b>K-1</b> Describe Standards of OHSAS of Process industry</p> <p><b>K-2</b> Enlist bio hazard industrial material</p> <p><b>K-3</b> Enlist PPEs during working with biohazard material</p> <p><b>K-4</b> Enlist safety precaution while working in biohazard</p>

		location
<b>I-4 Demonstrate Mechanical shop safety</b>	<p>A competent individual must be able to:</p> <p><b>P-1 Demonstrate Personal safety required in Mechanical workshop according to SOPs</b></p>	<p>A competent individual must be able to successfully:</p> <p><b>K-1 Enumerate mechanical shop safety precautions</b></p>
<b>I-5 Demonstrate electrical shop safety</b>	<p>A competent individual must be able to successfully:</p> <p><b>P-1 Demonstrate Personal safety in Electrical/electronic workshop according to SOPs</b></p>	<p>A competent individual must be able to successfully:</p> <p><b>K- Enumerate electrical shop safety precautions</b></p>
<b>I-6 Demonstrate first aid application</b>	<p>A competent individual must be able to:</p> <p><b>P-1 Provide first aid to the victim of electrical shock to save life</b></p>	<p>A competent individual must be able to successfully :</p> <p><b>K-1 Describe first aid application procedure</b></p>

**Tools and  
Equipment list**

Exemplary quantity of tools and equipment, tabulated for a session of 16 Trainees

<b>Sr. No.</b>	<b>Description</b>	<b>Quantity (No.)</b>
1.	Adjustable power supply for AC and DC voltages	06
2.	Adjustable wrench 6" , 8" , 12"	16
3.	Air compressor set	01
4.	Air dryer	01
5.	Air Regulator set	01
6.	Air Tank	01
7.	Allen key set (mm size) , star keys	16
8.	AVO meter Analogue 20k/volt impedance	09
9.	AVO meters digital 4 ½ digits	17
10.	Cable knife	16
11.	Calibration test bench for various Instruments	02
12.	Chisels for Metal & Wood (Flat, round & diamond point) , Centre punch	16
13.	Crimping Tool	10
14.	Electrical and hand drill machine set	03
15.	Electrical voltage / Phase tester	17
16.	Extension cable	03
17.	FRL units	02
18.	Gauge Manifolds (R-134a+R-22)	09
19.	Gauges (assorted)	10

20.	Grip Pliers	17
21.	Hacksaw (for wood and metal)	17
22.	Hand Tube Benders (different sizes)	09
23.	Label printer	02
24.	Measuring tapes	17
25.	Mechatronics simulator station	06
26.	Number punch and alphabet punch	04
27.	Oil separator	03
28.	Old and damaged instruments for better inspiration	-
29.	Pinching Pliers	09
30.	Pipe wrench 6" , 8"	16
31.	Piping and Tubing Training System	04
32.	Pliers set (combination, side cutter and nose)	16
33.	Pneumatic filters	03
34.	Pneumatic valves (assorted)	20
35.	Pressure calibrator (druck) 0 ~ 20 bar	06
36.	Process Control Simulator , SCADA Software	04
37.	Process Control Training System	02
38.	Programmable Logic Controller with Simulator	04
39.	PLC Trainers	03
40.	Pumps (+ve and -ve pressure) Training System	04
41.	Reaming Tool, thread taps and dies with handle	10
42.	Rubber Mallets (Small + medium)	16
43.	Scissors (small)	16
44.	Screw Driver set, (Flat, Phillips, Star)	16
45.	Scribers and dividers	16



46.	Sling Psychrometer, Hygrometers	05
47.	Snap ring pliers (internal & external)	06
48.	Socket spanner (with ratchet handle, mm size)	17
49.	Soldering iron 200 watts	12
50.	Soldering iron 25 / 35 watt	17
51.	Soldering sucker	09
52.	Soldering station	04
53.	Spanner Set (mm size)	17
54.	Steel Hammers	16
55.	Steel rulers	16
56.	Table / bench vise	10
57.	Temperature meters (digital)	05
58.	Tool box	15
59.	Tube Cutters with scrapper	17
60.	Tweezers	10
61.	Vernier calliper	10
62.	Watch maker screw drivers set	16
63.	Water separator	03
64.	Water regulator	03
65.	Welding mini plant (electric)	02
66.	Wire brush , paint brush, emery paper	16
67.	Wire stripper	10

**List of consumables**

Exemplary Quantity of consumables , tabulated for a session of 16 Trainees

<b>Sr. No.</b>	<b>Description</b>	<b>Quantity (No.)</b>
1.	Asbestos tape assorted width	04
2.	Bare copper wire 19/20 SWG, kg	02
3.	Cable wire 90 meter role for data transmission (single core)	04
4.	Cable wire 90 meter role for electrical wiring (3/.029)	03
5.	Cable ties (assorted )	10 packets
6.	Cable ties (different size)	10 packets
7.	Compression fittings with ferrules and caps	-
8.	Cotton gloves Pair	12
9.	Cotton rags kg	10
10.	Electrical switch gears (assorted)	100
11.	Electronics passive components (assorted)	500
12.	Electronics active /semiconductor components (assorted)	1000
13.	Filters (assorted)	-
14.	Gas kit	-
15.	High pressure hose pipe	-

16.	Hydraulic fittings	-
17.	Hydraulic fluid (general purpose) 500 grams tin	04
18.	lugs	10 assorted
19.	Meter probes set	09
20.	Oil seals(general purpose)	-
21.	Old and damaged mechatronics related instruments/equipment /parts	-
22.	Pipe jointing sealant (PVC) 100 Grams	02
23.	Pipe jointing solution (GI) 100 Grams	02
24.	Pneumatic fittings	-
25.	Retaining ring (assorted)	100
26.	Pneumatic Scaffolds	20
27.	Soldering wire 50/50 thick 500 grams role	4
28.	Soldering wire , 40/60 fine 500 grams role	4
29.	SST tubes and plastic tubes (different sizes)	-
30.	Teflon tape roll	6
31.	Welding rods	