PERFORM INDUSTRIAL AUTOMATION

UNIT CODE: SEC/OS/ET/CR/05/6/A

UNIT DESCRIPTION

This unit covers competencies required to perform industrial automation. Competencies include; installing industrial sensors and transducers, installing automation components and hardware, installing machine systems, installing robots and robotic systems, and installing programming software

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
1. Install industrial sensors and transducers	1.1 Sensors and transducers are identified based on their applications 1.2 Actuators are identified as per their output functions 1.3 Active sensors are determined based on their excitation external power 1.4 Passive sensors are determined in line with their signal output 1.5 Signal conditioning is performed in regard to expected energy output 1.6 Operational amplifiers are identified as per their configuration 1.7 Filters are identified as based on expected output frequencies 1.8 Noise in output signals is determined in line with standard operating procedures 1.9 Sensors and transducers are applied in adherence to manufacturer's manuals
2. Install automation components and hardware	2.1 Controllers are applied in accordance to I/O management of the automation system 2.2 Controllers are applied based on their computing and calculating requirements in the system 2.3 Multivariable control is identified in line with expected system performance 2.4 Industrial computers are applied as per nature of tasks required to run the system 2.5 Memory size and distribution is selected basing on the system requirements 2.6 Computer networking is performed based on

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
	system requirements 2.7 ***Distributed Control Systems*** (DCSs) are installed in line with system configuration 2.8 DCSs are connected to sensors and actuators as per the system requirements 2.9 DCSs are configured based on the system requirements (batch or continuous oriented) 2.10 ***Programmable Logic Circuits*** are applied as per electromechanical system control requirements 2.11 PLCs are installed as per packaging and semiconductor machine requirements 2.12 PLC is selected in regard to complexity of the system 2.13 PLC is installed in adherence to OSHA 2.14 PLC I/O are connected based on system requirements 2.15 PLC software programming is performed in accordance to manufacturer's standard operating procedures 2.16 ***Human Machine Interfaces*** are selected based on the operation requirements 2.17 HMI are programmed as per standard as per manufacturer's standard operating procedures 2.18 Encoders and resolvers are selected in line with system requirements 2.19 Output devices are selected as per microprocessor or microcomputer-based vision processing for inspection and measurement tasks 2.20 Bar Codes***, Radio Frequency identification*** (RFID) and Inductive ID are selected based on the system machine visible and readable formats 2.21 Power control devices are selected in line with system power ratings 2.22 Power control devices are installed in line with OSHA 2.23 Power control devices are installed in adherence to IEE regulations 2.24 Cables are distributed and terminated in line with OSHA

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
	2.25 Distribution blocks are selected based on the size of cables gauges 2.26 Transformers are installed in regard to isolation and transfer of electrical energy requirements of the system 2.27 Power supplies are installed based on energy requirements to various circuits in the automation system 2.28 ***Special purpose motors*** are identified as per their functionality 2.29 Variable Frequency Drives are installed based on power conversion requirements of the system 2.30 Electrical enclosures are selected in consideration of national and international standards
3. Install machine systems	3.1 Conveyors are installed in line with machine movement configuration 3.2 Conveyors are categorized based on material movement requirements 3.3 Conveyor accessories are installed in line with conveyor and machine functionality 3.4 Indexers are installed based on their functionality 3.5 Part feeders are identified as per system requirements 3.6 Part feeders are categorized based on their functionality 3.7 Escapements are identified in line with the system functionality 3.8 Escapements are applied as per conveying system, feeders, pallet indexing systems and assembly configurations
4. Install robots and robotic systems	4.1 Robotic automation is analyzed as per the automation system requirements 4.2 Robot configurations are selected in line with specifications of speed, positions to be attained and the cost of the system (articulated robots, SCARA robots and Cartesian coordinate robots) 4.3 Robot components are selected based on robot

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***(Bold and italicised terms are elaborated in the Range)***
	specifications 4.4 Robots and robotic systems are installed in regard to system requirements 4.5 Robot movements and positions are configured in consideration of coordinate systems
5. Install programming software	5.1 Software to be installed is selected basing on manufacturer specifications of the hardware 5.2 Programming concepts are selected in line with software functionality 5.3 PLC, DCS, embedded systems and robot controllers are programmed as per their functionality 5.4 Programming languages are selected as per nature of the software to be developed 5.5 Program is developed in consideration of reliability, robustness, usability, efficiency, effectiveness, portability, maintenance characteristics 5.6 Programming methodologies are selected in line with nature of program to be developed 5.7 Pneumatic, hydraulic and electrical circuits are developed by use of CAD programs based on the circuits design 5.8 Analysis software is applied in sizing servomotors, determining stresses on mechanical systems and calculating other factors in line with system design 5.9 ***Supervisory control and data acquisition*** (SCADA) packages are applied as per the nature of automated control system

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Automation system components and hardware may include but not limited to:	• Microcontrollers and microprocessor • DCS • PLC • SCADA • RFID • Conveyors • Indexers and escarpments • Robots • Relays • Contactors • Switches • Valves
2. Safety and precautions measures may include but not limited to:	• Are activities and precautions taken to improve safety in a workplace • OSHA regulations • IEE regulations • National and international standards
3. Programming software may include but not limited	• PLC programming • SCADA programming • SCARA, articulate and Cartesian robotic programming

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

- Safety during installation and maintenance of automation system
- National and international standards
- Installation of various automation systems
- Configuration of robots and robotic systems
- Operation monitoring
- Communication networks and protocols
- Manufacturer's specifications and recommendations
- Troubleshooting methods
- Controlled process
- Control components of automation systems
- Programming standards

FOUNDATION SKILLS

The individual needs to demonstrate the following additional skills

- Communications
- Proficient in analysis of automation systems
- Time management;

- Faults troubleshooting
- Decision making;
- Report writing;
- Analytical
- Problem solving;
- Planning

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and understanding and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified Sensors, transduces as per expected energy forms to be detected 1.2 Identified actuators based on their output functions 1.3 Determined sensors in line with their excitation external power identification 1.4 Identified operational amplifiers based on their configuration 1.5 Identified filters in line with their expected output frequencies 1.6 Determined noise in output signals and eliminated in accordance to standard operating procedures 1.7 Applied controllers based on I/O management of the automation system 1.8 Networked controllers as per the system configuration 1.9 Applied controllers based on their computing and calculating requirements in the system 1.10 Installed distributed Control Systems (DCSs) in line with the configuration of the system 1.11 Connected DCSs to sensors and actuators based on the system requirements 1.12 Configured DCSs based on the system requirements (batch or continuous oriented) 1.13 Applied Programmable Logic Circuits in regard to electromechanical system control requirements 1.14 Installed PLCs in accordance to packaging and semiconductor machine requirements 1.15 Selected PLC based on complexity of the system 1.16 Selected human Machine Interfaces as per operation requirements 1.17 Selected Bar Codes, Radio Frequency identification (RFID) and Inductive ID in line with system complexity

	1.18 Installed power control devices adherence to OSHA 1.19 Installed transformers based on isolation and transfer of electrical energy requirements of the system 1.20 Installed conveyors in line with machine movement configuration 1.21 Installed indexers are installed as per their functionality 1.22 Identified part feeders based on system requirements 1.23 Identified escarpments in line with the system functionality 1.24 Analysed robotic automation based on automation system requirements 1.25 Selected software to be installed in accordance to manufacturer specifications of the hardware 1.26 Programmed PLC, DCS, embedded processor, robot controllers in line with their functionality 1.27 Developed program in consideration of reliability, robustness, usability, efficiency, effectiveness, portability, maintenance characteristics 1.28 Developed pneumatic and electrical circuits are by use of CAD programs based on the circuits design
2. Resource Implications	Resources the same as that of workplace are advised to be applied Included: computers, switches, PLCs, DCS, SCADA programming software, timers, relays, Conveyors, etc.
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical Tests 3.3 Observation
4. Context of Assessment	Competency may be assessed 4.1 On job 4.2 Off job 4.3 During Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.