

PERFORM MECHATRONIC SYSTEMS INSTRUMENTATION AND CONTROL

UNIT CODE: ENG/OS/MC/CR/04/6/A

Unit description

This unit covers the competencies required to install mechatronic systems. It involves competencies; observe occupational health and safety, design a control system, document the control system design and specifications, install mechatronic instrumentation and control system, analyze instrumentation and control data and service and/or repair system faults

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
These describe the key outcomes which make up workplace function.	These are assessable statements which specify the required level of performance for each of the elements. <i>Bold and italicized terms are elaborated in the Range.</i>
1. Observe occupational health and safety	1.1 <i>Personal protective equipment</i> (PPE) are used according to OSHA 2007 1.2 <i>Tools and equipment</i> are stored and maintained correctly according to manufacturer's specifications 1.3 Tools and equipment are used correctly according to designated purpose 1.4 Workspace housekeeping is maintained according to Standard operating procedures (SOPs) 1.5 Workplace is planned according to design specifications.
2. Design a control system	2.1 Mechatronic system to be controlled problem is defined according to user needs 2.2 User manuals for the mechatronics systems are obtained and studied for system functionality 2.3 Circuit diagrams for the control system are modelled according to the functionality of the mechatronic systems 2.4 Resulting models are analysed and their properties determined according to system functionality 2.5 Control variables (outputs) to be controlled are decided according to the prescribed mechatronic system functionality 2.6 Measurement and manipulated variables are selected according to system functionality 2.7 Controller type and its configuration to be is selected according to the system performance

	<p>2.8 Controller is designed according to the system specifications</p> <p>2.9 Controller components and their specifications are selected, acquired and inspected according to the prescribed system functionality</p> <p>2.10 Tools and equipment are selected according to the control system circuit diagram</p> <p>2.1 Mechatronic system is analysed to test compatibility with the designed controller according to system specifications</p> <p>2.2 Controlled mechatronic system is simulated according to system specifications</p> <p>2.3 Hardware and software are selected and controller implemented according to prescribed system specification</p> <p>2.4 Testing and validation of the control system is done and tuning done according system specification.</p>
<p>3. Document the control system design and specifications</p>	<p>3.1 Technical report is developed according to the control system design and specifications.</p> <p>3.2 Operation and maintenance manual is developed according to control system design and specifications</p> <p>3.3 The control system design is patented according to Industrial Property Act,2001</p>
<p>4. Install mechatronic instrumentation and control system</p>	<p>4.1 Existing mechatronic system manuals are obtained from the user and studied for the system performance</p> <p>4.2 Safety and precaution measures are observed according OSHA</p> <p>4.3 Tools and equipment are selected according system functionality</p> <p>4.4 Interfacing of the controller and the mechatronic system is done according to prescribed system performance</p> <p>4.5 System performance is studied, monitored, tested an evaluated according to prescribed system specification</p> <p>4.6 Calibration of the system is done according to the system functionality</p> <p>4.7 Documentation is done for future reference and use</p> <p>4.8 System is commissioned for use according to the prescribed functionality</p>

<p>5. Analyse instrumentation and control data</p>	<p>5.1 Data to be analysed is decided according to the inputs and the outputs of the controller and the mechatronic system performance</p> <p>5.2 Methods of data collection is selected according system performance</p> <p>5.3 Data from the system is collected according to system performance</p> <p>5.4 Documentation of the collected data is done according to the system performance</p> <p>5.5 Data is interpreted and analysed according to the system performance</p> <p>5.6 Interpreted and analysed data is documented for future use</p>
<p>6. Service and/or repair system faults</p>	<p>6.1 Installation manuals are obtained from the user and analysed for functionality of the system</p> <p>6.2 Safety and precaution measures are observed according OSHA.</p> <p>6.3 Tools and equipment are selected according to installation and service manuals</p> <p>6.4 System testing is done for comparison with the manufacturer's specifications and system functionality.</p> <p>6.5 Fault diagnosis is done according to service manuals instructions</p> <p>6.6 Faulty units removed and replaced with new ones and moving parts lubricated according to the system performance</p> <p>6.7 System is tested against the required specifications</p> <p>6.8 Scheduling of the next service is done according to SOPs</p> <p>6.9 Documentation is done for future use and reference</p>

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
Tools and equipment may include but is not limited to:	<ul style="list-style-type: none"> • Hand tools • Power tools • Machines
PPEs may include but is not limited to:	<ul style="list-style-type: none"> • Overall/dust coats • Helmets • Nose masks

Variable	Range
	<ul style="list-style-type: none"> • Ear muffs • Safety boots
Controller components may include but is not limited to:	<ul style="list-style-type: none"> • PLC • Contactors • Relays • Displays • Keyboards and keypads • Control Buttons/switches
Data may include but is not limited to:	<ul style="list-style-type: none"> • Power • Temperature data • Pressure data • Current and voltage • Frequency • Heat
Methods of data collection may include but is not limited to:	<ul style="list-style-type: none"> • Observation • Experiments • Questionnaires

REQUIRED KNOWLEDGE

The individual needs to demonstrate knowledge of:

- Electrical circuit design
- Mechanical structural design
- Computer Aided Design
- Mechatronic programming
- Technical report writing
- Data analysis and interpretation
- Interpretation of technical drawings
- Documentation
- Types of tools and equipment
- Electrical and mechanical machine drives
- Testing and inspection
- Sensors and transducers
- Robotics and automated processes
- Hydraulics and pneumatics systems
- Service and maintenance of mechatronics processes
- Control and instrumentation
- Integration of control to mechatronic system

REQUIRED SKILLS

The individual needs to demonstrate skills in:

- Communication skills
- Problem solving
- Creativity and innovation
- Data collection and analysis
- Use of tools and equipment
- Technical presentation
- Technical drawing
- Installation and fabrication
- Interpretation of installation manuals
- Integration of robotics and automated processes
- Service and maintenance
- Control and instrumentation interfacing

EVIDENCE GUIDE

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

1 Critical Aspects of Competency.	1.1 Observed occupational health and safety 1.2 Designed a control system 1.3 Documented the control system design and specifications 1.4 Installed mechatronic instrumentation and control system 1.5 Analysed instrumentation and control data 1.6 Serviced and/or repaired system faults
2 Resource Implications.	2.1 Computers 2.2 Software 2.3 Projectors 2.4 Markers 2.5 Whiteboards 2.6 Tools and equipment 2.7 Whiteboard markers
3 Methods of Assessment.	Competency may be assessed through: 3.1 Practical 3.2 Observation 3.3 Questionnaire 3.4 Case studies 3.5 Written examinations 3.6 Oral presentation
4 Context of Assessment.	4.1 Competency may be assessed individually in an actual workplace or in work-simulated conditions within accredited institutions.

5 Guidance information for assessment.	5.1 This unit may be assessed on an integrated basis with others within this occupational sector.
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