

APPLY ELECTRICAL INSTRUMENTATION

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

UNIT DESCRIPTION

This unit covers the competencies required to apply electrical instrumentation. Competencies include; demonstrating understanding of measurements, apply analogue instruments, apply electromechanical instruments, apply digital instruments, measurement of electrical and physical quantities, apply waveform analyzing instruments, applying sensors, transducers and calibrating instruments.

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. <i>(Bold and italicised terms are elaborated in the Range)</i>
1. Demonstrate understanding of measurements	1.1 Units, dimensions and standards are identified in accordance with engineering practices 1.2 Conversions of units is performed in line with standard operating procedures 1.3 Dimensions of various quantities are determined based on their applications 1.4 Measurement standards are identified as per their applications 1.5 Measurement errors are determined based on standard operating procedures 1.6 Accuracy, precision, resolution, sensitivity and significant figures are determined in line with standard operating procedures 1.7 Instruments are applied as per their functionality
2. Apply analogue instruments	2.1 Analogue meters are classified based on their functionality 2.2 Analogue meters are applied in line with standard operating procedures 2.3 Errors are determined based on the instruments and component error combinations 2.4 Errors are analysed as per standard operating procedures
3. Apply electromechanical instruments	3.1 Permanent magnet moving coil (PMC) instruments are applied as per standard operating procedures 3.2 PMC is applied in accordance with their application in the galvanometers, dc ammeters,

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	<p>dc voltmeters, ac ammeters and ac voltmeters</p> <p>3.3 Iron moving instruments are applied as per standard operating procedure</p> <p>3.4 Internal resistances for ammeters and voltmeters are determined in line with established procedures</p> <p>3.5 Types of electromechanical instruments are applied basing on their function and range applications</p> <p>3.6 Electrodynamic instruments are applied in accordance with their functionality</p> <p>3.7 Electrodynamic instruments are applied in consideration of their applications as voltmeter, ammeter and wattmeter</p> <p>3.8 Energy meters are applied as per standard operating procedure</p>
<p>4. Apply digital instruments</p>	<p>4.1 Demonstrate understanding of logic gates based on their applications</p> <p>4.2 Demonstrate understanding of digital counting as per standard operating procedures</p> <p>4.3 Demonstrate understanding of flip flops circuits basing on their applications</p> <p>4.4 Demonstrate understanding of LEDs, LCDs, & seven segment displays, encoders, as per standard operating procedure</p> <p>4.5 Analogue to digital converters are determined based on their applications</p> <p>4.6 Digital to analogue converters are determined based on based on applications</p> <p>4.7 Digital instruments accuracy and resolutions are determined as per their functionalities.</p>
<p>5. Measure electrical and physical quantities</p>	<p>5.1 Identify methods of resistance measurements in regard to standard operating procedures</p> <p>5.2 Wheatstone bridge resistance measurement is performed as per standard operating procedures</p> <p>5.3 High resistance measurement are performed as per standard operating procedures</p> <p>5.4 RC, RL and RLC series and parallel circuits are</p>

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	<p>identified as per standard operating procedure</p> <p>5.5 Q factor is determined based on standard operating procedure</p> <p>5.6 Types of AC and DC bridges are determined in regard to established procedures</p> <p>5.7 Apply digital multimeters as per standard operating procedures</p> <p>5.8 Apply the Q meters in regard to established procedures</p> <p>5.9 Physical quantities are measured according as per the SOPs</p>
<p>6. Apply waveform analysing instruments</p>	<p>6.1 Analogue and digital oscilloscope are identified as per standard operating procedure</p> <p>6.2 Maintenance of oscilloscopes is performed in line with standard operating procedures</p> <p>6.3 Operation of oscilloscopes is performed based on its applications</p> <p>6.4 Oscilloscope specifications are determined in accordance to scope of measurements to be performed</p> <p>6.5 Special oscilloscope are applied as per standard operating procedures</p> <p>6.6 Performance of a spectrum analyser is determined based on its operation</p> <p>6.7 Logic analysers are applied as per standard operating procedures</p>
<p>7. Apply sensors and transducers</p>	<p>7.1 Sensors and transducers are identified in line with their applications</p> <p>7.2 Sensors and transducers are classified as per their functionality</p> <p>7.3 Sensors and transducers are determined in line with their specifications</p> <p>7.4 Signal processors are identified based on their processing ratings</p> <p>7.5 Signal processors are identified in line with their applications</p> <p>7.6 Data presentation methods are determined based on the nature of the output signal displays</p>

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<p>8. Calibrate instruments</p>	<p>8.1 <i>Digital and analogue instruments</i> are calibrated as per standard procedure</p> <p>8.2 Instruments are calibrated in regard to their deflection range</p> <p>8.3 Electromechanical and electronic ohmmeter are calibrated in line with standard operating procedures</p> <p>8.4 Wattmeter, voltmeter and ammeter is calibrated as per standard operating procedure</p> <p>8.5 Standard calibrating instruments are identified based on their operating parameters</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
<p>1. IEC Standards may include but not limited to:</p>	<ul style="list-style-type: none"> • IEC 62257 • IEC 60364 • IS 732/IEC 60364
<p>2. Output parameters may include but not limited to:</p>	<ul style="list-style-type: none"> • Current • Voltage • Frequency
<p>3. Digital and analogue instruments may include but not limited to:</p>	<ul style="list-style-type: none"> • Voltmeter • Ammeter • Ohmmeter • Wattmeter • Oscilloscope • Spectrum analyzer • Distortion meter • Q meter

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

- Digital and analogue instruments
- Analogue electronics
- Digital electronics
- Instrumentation and calibration
- Sensors and transducers
- Physical quantities
- Measurement

FOUNDATION SKILLS

The individual needs to demonstrate the following additional skills:

- Engineering principles
- OSHA, WSHA, and industry safety procedures and regulations
- Operate test equipment and interpret results
- Metering and interconnection
- Teamwork
- Troubleshooting
- Read and understand
- Symbols and schematics

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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 units, dimensions and standards in line with engineering practices 1.2 Performed conversions of units in line with standard operating procedures 1.3 Determined dimensions of various quantities in line with their applications 1.4 Classified analogue meters as per their functionality 1.5 Applied analogue meters in line with standard operating procedures 1.6 Identified errors in analogue meters as per effect on measurements 1.7 Applied the permanent- magnet moving coil (PPMC) instrument as per standard operating procedures
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	<p>1.8 Applied PPMC based on the application in the galvanometers, dc ammeters, dc voltmeters, ac ammeters and ac voltmeters</p> <p>1.9 Applied moving iron instruments as per standard operating procedure</p> <p>1.10 Applied electrodynamics instruments as per their functionality</p> <p>1.11 Demonstrated understanding of logic gates in regard to their application</p> <p>1.12 Demonstrated understanding of latches registers and counters.</p> <p>1.13 Demonstrated understanding of flip flops in line with their applications</p> <p>1.14 Demonstrated understanding of LEDs, LCDs, & seven segment displays, encoders, decoders, duplex and optical fibre based on standard operating procedure</p> <p>1.15 Determined analogue to digital converters are determined as per their applications</p> <p>1.16 Identified methods of resistance measurements as per standard operating procedures</p> <p>1.17 Performed Wheatstone bridge resistance measurement as per standard operating procedures</p> <p>1.18 Identified RLC, RC and RL series and parallel circuits in line with standard operating procedure</p> <p>1.19 Determined Q factor using standard operating procedure</p> <p>1.20 Determined types of AC and DC bridges using established procedures</p> <p>1.21 Applied digital multimeters as per standard operating procedures</p> <p>1.22 Identified analogue and digital oscilloscope based on standard operating procedure</p> <p>1.23 Performed maintenance of oscilloscopes in line with standard operating procedures</p> <p>1.24 Performed operation of oscilloscopes as per its applications</p> <p>1.25 Determined oscilloscope specifications based on the scope of measurements to be performed</p> <p>1.26 Applied special oscilloscope as per standard operating procedures</p> <p>1.27 Determined basic circuitry of a distortion meter based on the meter configuration</p> <p>1.28 Determined performance of distortion meter in line with scope of work to be performed</p> <p>1.29 Identified sensors and transducers in line with their applications</p> <p>1.30 Classified sensors and transducers based on their</p>
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	<p>functionality</p> <p>1.31 Determined sensors and transducers in line with their specifications</p> <p>1.32 Identified signal processors in line with their applications</p> <p>1.33 Determined data presentation methods basing on the nature of the output signal displays</p> <p>1.34 Calibrated digital and analogue instruments as per standard operating procedure</p> <p>1.35 Calibrated instruments based on their deflection range</p> <p>1.36 Calibrated electromechanical and electronic ohmmeter as per standard meters</p> <p>1.37 Calibrated wattmeter, voltmeter and ammeter in line with standard operating procedure</p> <p>1.38 Identified standard calibrating instruments based on their operating parameters</p>
2. Resource Implications	<p>Resources the same as that of workplace are advised to be applied</p> <p>Included: Digital and analogue instruments, oscilloscopes, sensors, transducers etc.</p>
3. Methods of Assessment	<p>Competency may be assessed through:</p> <p>3.1 Oral questioning</p> <p>3.2 Practical Tests</p> <p>3.3 Written Tests</p> <p>3.4 Written tests</p>
4. Context of Assessment	<p>Competency may be assessed</p> <p>On job</p> <p>Off job</p> <p>During Industrial Attachment</p>
5. Guidance information for assessment	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>