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|---------------------------------|------------------------|
| <b>Module Title:</b>            | Process Measurements 2 |
| <b>Language of Instruction:</b> | English                |

|                 |   |
|-----------------|---|
| <b>Credits:</b> | 5 |
|-----------------|---|

|                   |   |
|-------------------|---|
| <b>NFQ Level:</b> | 7 |
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|                            |                                |
|----------------------------|--------------------------------|
| <b>Module Delivered In</b> | <a href="#">1 programme(s)</a> |
|----------------------------|--------------------------------|

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| <b>Teaching &amp; Learning Strategies:</b> | The module will be delivered using lectures and practical sessions. The lectures will incorporate a mixture of presentations, example and student exercises/problem-solving, question and answer sessions, group discussions and online resources. Use will be made of "hands-on" laboratory programmes to promote greater student engagement with the learning process by facilitating them to apply and implement the concepts explored in the classroom. Students will also work collaboratively from time to time in the completion of exercises and development of solutions. |
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| <b>Module Aim:</b> | The aim of this module is to provide students with an in-depth understanding of the design, operation and application of Flow Measurement, Smart Instrumentation, Weighing Systems and Explosive Atmospheres. |
|--------------------|---|

| <b>Learning Outcomes</b>  |   |
|---|---|
| <i>On successful completion of this module the learner should be able to:</i> |   |
| LO1   | Demonstrate knowledge of the principles of operation for Flow Measurement, Smart Instrumentation, Weighing Systems and Explosive Atmospheres safety systems.    |
| LO2   | Determine appropriate safety precautions for working in explosive atmospheres.  |
| LO3   | Select and apply the appropriate type of instrument to suit specific process applications.  |
| LO4   | Implement correct configuration, calibration, adjustment and diagnostic procedures for a range of smart instruments including flow meters and weighing systems. |

| <b>Pre-requisite learning</b>  |  |
|--|--|
| <b>Module Recommendations</b><br><i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>         |  |
| No recommendations listed  |  |
| <b>Incompatible Modules</b><br><i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i> |  |
| No incompatible modules listed   |  |
| <b>Co-requisite Modules</b>  |  |
| No Co-requisite modules listed   |  |
| <b>Requirements</b><br><i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>          |  |
| No requirements listed   |  |

**Module Content & Assessment**
**Indicative Content**
**Flow Measurement**

Types of Flow Systems. Operation, construction, selection, application, installation and sources of errors for various types of Flow Meters. Calculating flow meter output for given process conditions along with calculating errors during calibration.

**Strain gauges and weighing systems**

Principles of operation for various types of strain gauges including stress, strain, young modulus of elasticity, including associated calculations for these terms. Determination of sensitive axis, non-sensitive axis, dummy gauge and active gauge, gauge factor, gauge resistance and sensitivity. Bridge measuring circuits; 1/4 bridge, 1/2 bridge, full bridge including output calculations from each type. Load cell types; 4 wire, 6 wire, effects of: overloading and shock loading. Calibration of Load Cells individually and collaboratively.

**Microprocessor Based Instrumentation**

HART Communication Protocol, frequency shift keying, Instrument configuration Types of memory, CPU, polling. • Types of memory, RAM/ROM, CPU, address bus, data bus, control bus, arithmetic logic unit.

**Hazardous Environments**

Main types of hazards and their classifications associated with explosive atmospheres. Types of protection for equipment in explosive atmospheres. Use and operation of Zener barriers and current standard associated with hazardous areas.

| Assessment Breakdown             | %      |
|----------------------------------|--------|
| Continuous Assessment            | 30.00% |
| Practical                        | 20.00% |
| End of Module Formal Examination | 50.00% |

**Continuous Assessment**

| Assessment Type        | Assessment Description  | Outcome addressed | % of total | Assessment Date |
|------------------------|---|-------------------|------------|-----------------|
| Case Studies           | Written assignment discussing measurement technologies covered in the module. | 1,2,3             | 20.00      | Week 13         |
| Short Answer Questions | Online/Classroom based test.  | 1,2,3             | 5.00       | Week 5          |
| Short Answer Questions | Online/Classroom based test.  | 1,2,3             | 5.00       | Week 10         |

No Project

**Practical**

| Assessment Type             | Assessment Description                                   | Outcome addressed | % of total | Assessment Date |
|-----------------------------|--|-------------------|------------|-----------------|
| Practical/Skills Evaluation | Configure, calibrate and discuss a weighing system.      | 1,3,4             | 10.00      | n/a             |
| Practical/Skills Evaluation | Configure, interrogate and report on a smart flow meter. | 1,3,4             | 10.00      | n/a             |

**End of Module Formal Examination**

| Assessment Type | Assessment Description | Outcome addressed | % of total | Assessment Date |
|-----------------|------------------------|-------------------|------------|-----------------|
| Formal Exam     | Written Exam           | 1,3,4             | 50.00      | End-of-Semester |

**Continuous Assessment**

| Assessment Type        | Assessment Description  | Outcome addressed | % of total | Assessment Date |
|------------------------|---|-------------------|------------|-----------------|
| Case Studies           | Written assignment discussing measurement technologies covered in the module. | 1,2,3             | 20.00      | Week 13         |
| Short Answer Questions | Online/Classroom based test.  | 1,2,3             | 5.00       | Week 5          |
| Short Answer Questions | Online/Classroom based test.  | 1,2,3             | 5.00       | Week 10         |

No Project

| <b>Practical</b>            |  |                          |                   |                        |
|-----------------------------|--|--------------------------|-------------------|------------------------|
| <i>Assessment Type</i>      | <i>Assessment Description</i>                            | <i>Outcome addressed</i> | <i>% of total</i> | <i>Assessment Date</i> |
| Practical/Skills Evaluation | Configure, calibrate and discuss a weighing system.      | 1,3,4                    | 10.00             | n/a                    |
| Practical/Skills Evaluation | Configure, interrogate and report on a smart flow meter. | 1,3,4                    | 10.00             | n/a                    |

| <b>End of Module Formal Examination</b> |                               |                          |                   |                        |
|---|-------------------------------|--------------------------|-------------------|------------------------|
| <i>Assessment Type</i>                  | <i>Assessment Description</i> | <i>Outcome addressed</i> | <i>% of total</i> | <i>Assessment Date</i> |
| Formal Exam                             | Written Exam                  | 1,2,3,4                  | 50.00             | End-of-Semester        |

**SETU Carlow Campus reserves the right to alter the nature and timings of assessment**

**Module Workload**

| <b>Workload: Full Time</b> |                  |  |
|----------------------------|------------------|--|
| <i>Workload Type</i>       | <i>Frequency</i> | <i>Average Weekly Learner Workload</i> |
| Lab/Lecture                | Every Week       | 3.00                                   |
| Independent Learning Time  | Every Week       | 6.00                                   |
| Total Hours                |                  | 9.00                                   |

| <b>Workload: Part Time</b> |                  |  |
|----------------------------|------------------|--|
| <i>Workload Type</i>       | <i>Frequency</i> | <i>Average Weekly Learner Workload</i> |
| Lab/Lecture                | Every Week       | 3.00                                   |
| Independent Learning Time  | Every Week       | 6.00                                   |
| Total Hours                |                  | 9.00                                   |

**Module Delivered In**

| Programme Code | Programme  | Semester | Delivery  |
|----------------|--|----------|-----------|
| CW_EMIMC_D     | <a href="#">Batchelor of Science in Industrial Measurement and Control</a> | 2        | Mandatory |