Title:	Instrument Measurement APPROVED
Long Title:	Instrument Measurement

Module Code:	PHYS6008	**Duration:**	1 Semester

Credits:	5
NFQ Level:	Fundamental
Field of Study:	Physics
Valid From:	Semester 1 - 2019/20 (September 2019)
Module Delivered in	7 programme(s)
Module Coordinator:	Donagh OMahony
Module Author:	MARTIN WOODS
Module Description:	This module introduces the learner to the principles of measurement using a range of instruments. This module will include the theory and principles of operation of instrumentation pertaining to process and other industries.

Learning Outcomes	
On successful completion of this module the learner will be able to:	
LO1	Describe and apply instrument parameters.
LO2	Explain the principles of operation of level, pressure, temperature and flow measurement instruments.
LO3	Operate pressure, level, temperature and flow instruments and report on their operation.
LO4	Describe industrial instrumentation as well as identify and explain the function of the major components.
LO5	Solve numerical problems associated with measurement instruments.

Pre-requisite learning
Module Recommendations *This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named MTU module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).*
None
Incompatible Modules *These are modules which have learning outcomes that are too similar to the learning outcomes of this module. You may not earn additional credit for the same learning and therefore you may not enrol in this module if you have successfully completed any modules in the incompatible list.*
None
Co-requisite Modules
No Co-requisite modules listed
Requirements *This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed. You may not enrol on this module if you have not acquired the learning specified in this section.*
None

Module Content & Assessment

Indicative Content
Instrument Measurement Principles Role of Instruments in Industrial Processes. Elements of a measuring system. Sensors and transducers. Instrument Parameters.
Data Acquisition Indicators. Recorders. Data Loggers.
Pressure Measurement and Instrumentation Definition of Pressure and Units. Absolute, Atmospheric and Gauge Pressure. Diaphragm gauge, bellows gauge, Bourdon gauge. Pressure transmitters.
Flow Measurement and Instrumentation Volume and mass flow rate; Turbulent flow, streamlined flow and Reynolds number; The Continuity Equation, Bernoulli's Equation and application to differential pressure devices; Differential pressure primary elements: orifice plate, Venturi tube, Dall tube, flow nozzle and Pitot-static tube. Positive displacement flow meters. Variable-area flow meters.
Level Measurement and Instrumentation Tank measurements: level, (%) fill, volume and mass. Direct level measuring systems: the dip stick, the sight glass, floats; differential pressure; purged dip pipe. Relationship between level and content (volume and mass) for cylindrical tanks.
Temperature Measurement and Instrumentation Definition of temperature and units. Thermometric properties of thermometers. Thermal expansion thermometers. Metal resistance thermometers and thermistors. Thermocouples.
Laboratory Practicals Response time of a thermocouple. Characteristics of the resistance thermometer and thermistor. Measurement of Orifice Plate and Venturi Tube Characteristics. Dip Pipe Level Measurement System. Strain Gauge Pressure Transducer. Pitot-static tube. Thermocouple characteristics.

Assessment Breakdown	%
Course Work	100.00%

Course Work

Assessment Type	*Assessment Description*	*Outcome addressed*	*% of total*	*Assessment Date*
Multiple Choice Questions	Theory Assessment 1 on the topics covered to the date of the assessment.	1,2,4	30.0	Week 7
Short Answer Questions	Theory Assessment 2. Mainly covering material covered in topics after the first assessment, but with some assessment of earlier material.	1,2,4,5	35.0	Sem End
Practical/Skills Evaluation	Instrumentation Experiment Worksheets/Reports	1,3,5	35.0	Every Week

No End of Module Formal Examination

Reassessment Requirement

Repeat examination
Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.

The institute reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Module content delivery.	3.0	Every Week	3.00
Lab	Instrumentation Laboratory	2.0	Every Second Week	1.00
Independent & Directed Learning (Non-contact)	Study of module material.	3.0	Every Week	3.00
			Total Hours	8.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	4.00

Workload: Part Time				
Workload Type	*Workload Description*	*Hours*	*Frequency*	*Average Weekly Learner Workload*
Lecture	Module content delivery.	2.0	Every Week	2.00
Lab	Instrumentation Laboratory.	2.0	Every Second Week	1.00
Independent & Directed Learning (Non-contact)	Additional content, problem sheets etc.	4.0	Every Month	1.00
Independent & Directed Learning (Non-contact)	Study of completed module material.	3.0	Every Week	3.00
			Total Hours	11.00
			Total Weekly Learner Workload	7.00
			Total Weekly Contact Hours	3.00

Module Resources

Recommended Book Resources

- **Bela G. Liptak (editor), Kriszta Venczel (editor) 2016, *Instrument and Automation Engineers Handbook: Process Measurement and Analysis, Volume 1*, 5th Ed., CRC Press [ISBN: 1466559322]**
- **Anders Andersson 2017, *Measurement Technology for Process Automation*, 1st Ed., CRC Press [ISBN: 113803594]**
- **Michael Reader-Harris 2016, *Orifice Plates and Venturi Tubes*, 1st Ed., Springer [ISBN: 3319359436]**

Supplementary Book Resources

- **N. E. Battikha, 2012, *The Condensed Handbook of Measurement and Control (Kindle Edition)*, 3rd Ed., ISA [ISBN: B0092WUBQ0]**
- **Alan S Morris 2015, *Measurement and Instrumentation: Theory and Application*, 2nd Ed., 21, Academic Press [ISBN: 0128008849]**
- **L Michalski 2001, *Temperature Measurement*, 2nd Ed., 22, John Wiley and Sons [ISBN: 0471867799]**

This module does not have any article/paper resources

Other Resources

- **Website: *International Society of Automation***
  http://www.isa.com
- **Website: *Institute of Measurement and Control***
  http://www.instmc.org

Module Delivered in

Programme Code	Programme	Semester	Delivery
CR_SESST_8	Bachelor of Science (Honours) in Environmental Science and Sustainable Technology	3	Mandatory
CR_SINEN_8	Bachelor of Science (Honours) in Instrument Engineering	1	Mandatory
CR_SPHYS_7	Bachelor of Science in Applied Physics and Instrumentation	1	Mandatory
CR_SICAL_6	Certificate in Process Instrumentation & Calibration	1	Mandatory
CR_SPHYS_6	Higher Certificate in Science in Applied Physics and Instrumentation	1	Mandatory
CR_SOMNI_7	Physical Sciences (Common Entry)	1	Mandatory
CR_SOMNI_8	Physical Sciences (Common Entry)	1	Mandatory