

NATIONAL METAL & ENGINEERING CURRICULUM

1. Module details

Module name	Density/Level
Nominal duration	One module It is anticipated that a student possessing the skills and knowledge developed in the prerequisites will achieve the module purpose in 35 to 40 hours.
Module code	NI203
Discipline code	0703325

2. Module purpose

This module aims to provide the student with the knowledge and skills in measurement of level and liquid density.

3. Prerequisites

Pressure (NI202)

4. Relationship to competency standards

This module provides some of the knowledge and skills underpinning competence in the following standards.

Federal Metals Industry Award Standards, Unit 18.62A.

Electrical Contracting Industry Award Standards
Instrument Stream Units 5.4, 5.5, 5.6, 5.7, 5.8

5. Content

Summary of content

1. Definitions
 - density
 - relative density (sg)Factors affecting density
2.
 - effect of depth and density on pressure in liquids
 - relative density
 - Archimedes principles
 - calculations of pressure in various fluids using formulaPressure = density x gravity x height

3.
 - float type (open and closed tanks)
 - displacement type
 - sight gauges
 - air purge (bubble pipe)
 - differential pressure cells:
 - electronic and pneumatic types use in open and closed tanks wet and dry legs
 - span elevation and suppression
 - SMART transmitters
 - 1:1 repeater (application of)
 - level repeater (pad)
 - diaphragm box
 - electronic hydrostatic head
 - ultrasonic
 - capacitance
 - resistance
 - nucleonic
4.
 - calculation of range, span, span elevation and suppression
 - calibrate electronic and pneumatic differential pressure cell transmitters to suit level or density application
 - calibrate as many other types as mentioned in section 2 (above) as resources allow
 - configure a differential pressure transmitter for a level measurement situation
5.
 - connection into a two wire system
 - connection of pneumatic systems

6. Assessment strategy

Assessment method	Short-answer tests and written Practical exercises
Conditions of assessment	Normally learning and assessment will take place in a classroom/laboratory environment.

7. Learning outcome details

On completion of this module the learner will be able to:

Learning outcome 1	Define density and relative density and identify factors affecting density.
Assessment criteria	1.1 Define density, relative density (sg). List factors affecting density.

Learning outcome 2

Apply the formula:
Pressure = (Rho) x g x h (PA).

Assessment criteria

- 2.1 State the formula $P\rho=gh$, explain the meaning of each of the formula and state the units in which each part is expressed.
- 2.2 Apply the formula $P\rho=gh$ to a given level measurement situation and calculate any one unknown in a given example.

Learning outcome 3

Describe the principle of operation and method of use of various types of level and/or density measuring instruments in common use.

Assessment criteria

- 3.1 Describe the principle of operation of the various level measuring devices.
- 3.2 State the factors which effect the selection of a level measuring device for a given level measurement situation.
- 3.3 List the factors which must be considered when installing the various level measuring devices to ensure efficient/reliable operation.
Describe setting up procedures of selected level measuring installation.

Learning outcome 4

For a given installation, calculate the required parameters and calibrate a level and /or density measuring instrument to suit that installation.

Assessment criteria

- 4.1 Calculate the Span, Range, and Span Elevation or Suppression for open and closed tank installations.
- 4.2 Using manufacturers workshop manual configure and calibrate a transmitter to suit a given level measuring application.
- 4.3 Describe how density is measured using fixed and variable head methods.

Learning outcome 5 Connect an electronic and a pneumatic level measuring instrument to an installation.

- Assessment criteria**
- 5.1 Connect an electronic level measuring device into an indicating or control loop and verify correct operation of the device in that system.
 - 5.2 Connect a pneumatic level measuring device into an indicating or control loop and verify correct operation of the device in that system.

8. Delivery of the module

Delivery strategy Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.

It is recommended that learning and assessment be facilitated in a holistic manner which may require a learning outcome sequence other than that indicated in the body of this module.

Also an integrated theory/practice approach should be used where students learn by experimentation and through research and laboratory reports.

Resource requirements To complete this module students will need access to sufficient measurement, test and signal generation equipment to allow each student to undertake individually the practical and assessment tasks.

Useful references include:

Bolton, W. 1991, *Instrumentation and Process Measurements*, Longman Group UK Limited.

Jones, E.B. 1985, *Jones' Instrument Technology*, Vols. 1 and 2, 4th edition, Butterworths, Borough Green, England.

Considine, D.M. 1985, *Process Instruments and Controls Handbook*, 4th edition, McGraw-Hill, New York.

Anderson, N.A. 1980, *Instrumentation for Process Measurement and Control*, 3rd edition, Chilton Company, Adnor, Pennsylvania.

Johnston, C. 1993, *Process Control Instrumentation*, 4th edition, Regents/Prentice Hall, Englewood Cliffs, New Jersey.

Occupational health and safety requirements A safe and healthy environment will be provided for students in regards to classroom and laboratory safety.