

NATIONAL METAL & ENGINEERING CURRICULUM

1. Module details

Module name	Fluid Flow
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	NI204
Discipline code	0703325

2. Module purpose

This module aims to provide students with the knowledge and skills required in the application and measurement of fluid flow.

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. The basic laws and characteristics of fluid flow including Berroullis Theorem of fluid flow, conservation of energy, basic of Reynolds numbers, turbulent and laminar flows (brief review only). Mention should be made to the difference between gas and liquid flow.
2. SI units pertaining to flow and conversion factors to SI units. Other specialised units of flow eg. barrels per hour in the oil industry.
3. The principles of operation of a range of quantity meters eg. oval meters, gear meters, reciprocating piston, notating disc, gas meter.

4. The principles of operation and characteristics of a range of differential head flow rate meters which includes the orifice plate, venturi tube and annular. The range may include the dall tube, flow nozzle and pitot tube. The characteristics should include the flow/DP relationship, pressure losses and effects of laminar flow or excessive turbulence on the accuracy of the meter.
5. The physical construction of typical examples of P flow rate meter which include materials, shapes of orifice, gas and liquid drains, tapping points and mounting position of DP transmitter and pipe work. Gas, liquid and stream flow examples should be examined in relation to these topics and installation.
6. The principles of operation and characteristics of a range of flow rate meters including the turbine meter vortex meter and magnetic flow meter. The range may include the ultrasonic method, belt weighing for solids, nucleonic and coriolis effect.
7. The physical construction and installation of typical examples of the above range of flow rate meter and the errors which may be encountered in use and the minimisation of these errors.
8. The principles of operation and characteristics of a range of shapes of flumes and weirs.
9. The physical construction and installation of typical examples of flumes and weirs. The sources of error which may be encountered with flumes and weirs and the minimisation of these errors.
10. Square root extraction in reference to DP meters, integration of flow rate, mass flow computations (coriolis effect) from flow rate and other measurements.

6. Assessment strategy

Assessment method

Short-answer tests
 Practical tests
 Objective tests

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	Describe the basic principles of fluid flow (gas and liquid).
Assessment criteria	<p>1.1 State the basic laws of fluid flow in relation to flow measurement.</p> <p>1.2 Identify types of fluid flow characteristics.</p>
Learning outcome 2	List the various units of fluid flow and flow rate.
Assessment criteria	2.1 Identify SI and other commonly used units.
Learning outcome 3	Describe the principles of operation of the common types of flow quantity meters.
Assessment criteria	3.1 Describe the principles of operation of selected quantity meters including positive displacement flow meters.
Learning outcome 4	Describe the principles of operation and characteristics of the differential head types of flow rate meter.
Assessment criteria	<p>4.1 Describe the principles of operation of the various differential head fluid flow meters.</p> <p>4.2 Identify the characteristics of differential head flow meter.</p> <p>4.3 Describe the construction of selected examples of DP flow rate meters.</p>
Learning outcome 5	Describe the principles of operation and characteristics of a range of flow rate meters, other than differential head types, in use in industry.
Assessment criteria	<p>5.1 Describe the principles of operation of selected flow rate meters.</p> <p>5.2 Identify the characteristics of selected flow rate meters.</p> <p>5.3 Describe the construction of selected flow rate meters.</p>

- Learning outcome 6** Describe the principles of operation of open channel flow meters.
- 6.1 Describe the principles of operation of flumes and weirs.
 - 6.2 Identify the characteristics of various shapes of flumes and weirs.
- Learning outcome 7** Explain the need for square root extraction, integration and other computations used in relation to fluid flow.
- 7.1 List the reasons for the need of automatic computation in relation to fluid flow.
- Learning outcome 8** List the essential requirements for the installation of a range of flow rate meters.
- 8.1 Select an appropriate differential flow meter for a given application.
 - 8.2 List the types of tapping points used with DP flow rate meters.
 - 8.3 Describe the pipework and mounting positions of the DP transmitter used with gas, steam and liquid flow metering.
 - 8.4 List the essential requirements for the installation of open channel flowmeters.
 - 8.5 List the essential requirements for the installation of a range of flow rate meters eg. magnetic flow, turbine, vortex, ultrasonic etc.
- Learning outcome 9** Calibrate various elements used in a flow installation.
- 9.1 Calibrate a typical flow measuring/transmitting device. (eg. ΔP , mass flow etc.)
- Learning outcome 10** Determine the flow characteristics of a flow rate meter from practical data.
- 10.1 Test and plot the characteristics of a flow rate meter.

Learning outcome 11

Set up and test a square root extraction instrument and/or a flow integrator.

11.1 Programme, calibrate or adjust a square root extractor or flow integrator.

11.2 Prepare a report on the performance of the instrument.

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.