Module Code
CEU33A03

Module Name
3A3 HYDRAULICS

ECTS Weighting
5 ECTS

Semester taught
Semester 2

Module Coordinator/s
Aonghus McNabola

Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline
On successful completion of this module, students should be able to:

LO1. Estimate flows in pipes and channels from devices such as notches, weirs and flumes.
LO2. Develop the head/discharge relationship for pipes, allowing for friction in the pipes and loss of head at bends etc.
LO3. Predict the depth variation in open channels.
LO4. Analyse & predict flows and head in pipe networks, including the effect of devices such as pumps within these systems.
LO5. Design water distribution networks, appraise differing design approaches and communicate design approaches to a lay audience.
LO6. Estimate the flow in gravity sewer systems and determine hydraulic loads from both wastewater and storm water under different design storm conditions, including for future climate change scenarios.
LO7. To design the size and assess the efficiency of a Combined Sewer Overflow at different settings.

Graduate Attributes: levels of attainment
To act responsibly - Introduced
To think independently - Enhanced
To develop continuously - Attained
To communicate effectively - Enhanced

Module Content
Hydraulics is a one semester module which provides students with the concepts of hydraulic engineering. The module reviews the relevant aspects of fluid flow developed in 2E5, such as Bernoulli’s equation, and the momentum and continuity relationships and demonstrates how these are developed for use in Civil Engineering design. The methods of developing head/discharge relationships for pipe flows which includes for friction loss are formulated. The principals involved in the flow of water in open channels are explained and relationships are developed to allow the estimation of the discharge in open channels and the depth variation behind
control structures. The methods used to analyse pipe networks, with and without pumps within the system, are developed. The design of water distribution systems providing an adequate supply of water to consumers is also examined. Finally, the module examines the subject of Urban Drainage, initially comparing combined systems against separate systems. The calculation of hydraulic loads for the network is then demonstrated for both wastewater quantities and also storm water predictions from the analysis of rainfall events. The hydraulic design of the pipe network to these loads is then examined before moving onto the design of Combined Sewer Overflows which are used to relieve the system hydraulically under storm conditions. The Course Curriculum includes:

- Velocity & Discharge Measurement
- The Momentum Equation
- Energy and Flow of water in pipes
- Open channel flow
- Pipe network analysis
- Pump-Pipe Systems
- Pumps
- Urban Drainage Systems
- Design of Water Distribution Systems

**Teaching and Learning Methods**

3A3 Hydraulics will be delivered through a combination of online and face to face lectures. The module will include a significant group design element where students will work together in competitive groups to complete the preliminary design of a water supply system, including technical design, reporting and presentation as a consulting bid/pitch. The module includes three laboratory practical exercises and reports dealing with pipe flow, open channel flow and pump systems. Two assignments must also be completed independently by students on pipe network analysis and open channel flow systems.
### Assessment Details

Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

### Assessment Component | Assessment Description | LO Addressed | % of total | Week due
---|---|---|---|---
Examination | 2 hour written examination | LO1-4 & 6-7 | 60% |  
Group Project |  | LO5 | 20% |  
Labs & Assignments |  | LO1-7 | 20% |  

### Reassessment Requirements

100% written examination

### Contact Hours and Indicative Student Workload

**Contact hours:** 33 lectures, 3 lab sessions, 2 tutorials

**Independent Study (preparation for course and review of materials):** 37hrs

**Independent Study (preparation for assessment, incl. completion of assessment):** 50hrs

### Recommended Reading List

*Mechanics of Fluids, Massey (Taylor & Francis).*

*Hydraulics in civil and environmental engineering,* Chadwick & Morfett (E & FN Spon).

*Urban Drainage,* Butler & Davies (E & FN Spon).

### Module Pre-requisite

### Module Co-requisite

### Module Website


### Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.

No
COVID-19 contingency statement:

While the intention is to deliver some lectures, tutorials and labs face-to-face, there is uncertainty due to the Covid-19 situation and the entire module delivery may need to change to an online delivery if required by government restrictions. In the case of a possible new lockdown scenario during teaching term:

- Some lectures, tutorials and labs will be delivered online using Blackboard. All of these sessions will be live sessions and your attendance at live sessions is required. The remaining activities will be delivered face to face subject to compliance with government guidance at the time.
- Assignments and examinations will be conducted and submitted online.