

Module Code	CEU33A11
Module Name	3A11 Fluids & Environment
ECTS Weighting¹	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	<p>On successful completion of this module, students should be able to:</p> <p>LO1. Estimate flows in pipes and channels from devices such as notches, weirs and flumes.</p> <p>LO2. Develop the head/discharge relationship for pipes, allowing for friction in the pipes and loss of head at bends etc.</p> <p>LO3. Predict the depth variation in open channels</p> <p>LO4. Analyse & predict flows and head in pipe networks, including the effect of devices such as pumps within these systems.</p> <p>LO5. Design water distribution networks, appraise differing design approaches and communicate design approaches to a lay audience.</p> <p>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.</p> <p>LO7. To design the size and assess the efficiency of a Combined Sewer Overflow at different settings.</p> <p>Graduate Attributes: levels of attainment</p> <p>To act responsibly - Introduced</p> <p>To think independently - Enhanced</p> <p>To develop continuously - Attained</p> <p>To communicate effectively - Enhanced</p>
Module Content	<p>Fluids & Environment is a one semester module which provides students with the concepts of hydraulic engineering of fluids in the built environment. 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</p>

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

3A11 will be delivered through face to face hybrid 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 Details² Please include the following: <ul style="list-style-type: none"> • Assessment Component • Assessment description • Learning Outcome(s) addressed • % of total • Assessment due date 	Assessment Component	Assessment Description	LO Addressed	% of total			
	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 Workload²	<table border="1"> <tr> <td>Contact hours: 33 lectures, 3 lab sessions, 2 tutorials</td> </tr> <tr> <td>Independent Study (preparation for course and review of materials): 37hrs</td> </tr> <tr> <td>Independent Study (preparation for assessment, incl. completion of assessment): 50hrs</td> </tr> </table>				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
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Recommended Reading List	<p><i>Mechanics of Fluids</i>, Massey (Taylor & Francis).</p> <p><i>Hydraulics in civil and environmental engineering</i>, Chadwick & Morfett (E & FN Spon).</p> <p><i>Urban Drainage</i>, Butler & Davies (E & FN Spon).</p>						
Module Pre-requisite							
Module Co-requisite							
Module Website	https://www.tcd.ie/Engineering/undergraduate/baiyear3/modules/3A3.pdf						
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No						
Module Approval Date							

Approved by

Academic Start Year

Sept 2022

Academic Year of Date

2022-23