



**UNIVERSITY *of* LIMERICK**  
OLLSCOIL LUIMNIGH

**CE4003**

**Lecture 0**  
**Fluid Mechanics**

**Syllabus**



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# WT4003 Fluid Mechanics

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- **Lecturer:** Dr. Colm Cryan
  - **Room:** SR2013
  - **email:** colm.cryan@ul.ie
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- **Successful students will come to class with assignments already attempted**



# Lecturer Bias

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- **Qualifications**
  - **BSc (honours) Physics**
  - **MEng (by Thesis)**
  - **PhD (by Thesis)**
  
- **Experience**
  - **Design Development and Deployment of ICT Infrastructure**
  - **Test facility Design, Build and Operation**
  - **Sustainability in Built Environment**
  - **Refurbishment of Heritage Buildings**
  - **Commercial Management**
  - **15 working in United States of America**
  - **Established BRE Ireland's Business**



# Academic Honesty

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- **The MST Department adheres to the strictest standards of academic honesty. An important aspect of achieving these standards is to be sure that students are aware of faculty expectations regarding academic honesty. This statement is an attempt to clarify these expectations as they apply to this course.**
- **Projects and Quizzes**
  - **Projects and Quizzes performed by students for submission serve the following two purposes:**
    - Are seen as educational devices to help students master the course material. This includes the concepts, theories, methodologies, and tools presented in class and recitation as well as such skills as working in teams.
    - Help the faculty evaluate how well each student has mastered the course material
  - **Thus, policies regarding academic honesty are intended to balance these two purposes and, unless otherwise stated, apply to all assignments**
  - **Students taking this class can work together to conceptualize general approaches to assignments. However, unless otherwise specified for a particular assignment, the work you submit must be done completely on your own. This includes text, numerical calculations, mathematical derivations, diagrams, graphs, computer programs and output. You are also expected to properly reference the source of any information used in a submission that is not your own. This includes any book, article, Web page, presentation or personal correspondence that you used for your work.**
  - **It is also inappropriate to use assignments, problem sets or projects submitted in previous years as a source, unless otherwise indicated.**
- **If you have any questions about how these policies relate to a specific situation, please speak to the teaching staff of this course for clarification**



# Aims and Objectives

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- **Introduce the Physical processes which govern the behaviour of liquids at rest and in motion, relating to hydraulic engineering.**



# Key Objectives

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- **Develop the fundamental principals underlying hydrostatics**
- **Introduce hydrodynamics principles and the basic laws of fluid flow**
- **Explain pipe flow in network design and basic hydraulic machinery**
- **Include theoretical and practical aspects of open channel flow**
- **Practical applications of hydraulic principals will be applied to different hydraulic structures to provide experience and confidence in problem-solving**



# On successful completion

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- **Apply conservation of mass, energy and momentum to fluid flow**
- **Compute hydraulic gradients and design pipe networks**
- **Distinguish the principals controlling open channel flow types**
- **Calculate flow through gates, weirs and flumes**
  
- **Inform your thought process through the building of models**
  - **Both theoretical and physical**



# Overview

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- **Introduction**
- **Principals**
- **Pipe Flow**
- **Open Channel Flow**
- **Measurement**



# Introduction (1 of 5)

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- **Properties of Fluids**
- **Hydrostatic Forces**
- **Hydrostatic Pressure**
- **Measurements**



# Principals (2 of 5)

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- **Principals for Fluid Flow**
- **Conservation**
  - **Mass**
  - **Momentum**
  - **Energy**
- **Continuity Momentum**
- **Bernoulli's Equations**
- **Application of Conservation Laws to Fluid Flows**



# Pipe Flow (3 of 5)

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- **Flow in Pipes**
  - Laminar Flow
  - Turbulent Flow
  - Critical Velocity
- **Darcy Weisbach equations**
- **Colebrook-White Equations**
- **Energy Loss in Pipe systems**
- **Hydraulic Gradients**
- **Pipe Networks**
  - Analysis using Hardy Cross balancing methods



# Open Channel Flow (4 of 5)

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- **Open Channel Flow**
- **Principals of uniform flow in channels**
- **Laminar flow**
- **Turbulent flow**
- **Cheze and Manning equations**
- **Reynold's Number**
- **Specific Energy and Critical Depth**
- **Hydraulic Jump**



# Measurement (5 of 5)

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- **Flow Measurement**
  - Orifices
  - Notches
  - Weirs
  - Venturi-flumes
- **Pipe flow meters**
- **Gauging of rivers and Streams**



# Project (will update)

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- **Student teams will come up with a project concept;**
  - Pick a course topic such a Siphon, Pipe Flow, Manometer, Turbulant flow
  - Introduce the topic
  - Analyse the theory and build a theoretical model in Excel
  - Build a physical model
  - Compare physical model to theoretical model
  - Report results (on an A0 or A1 poster)
- **Project will be assessed for displayed level of;**
  - Knowledge
  - Comprehension
  - Application
  - Analysis
  - Synthesis
  - Evaluation

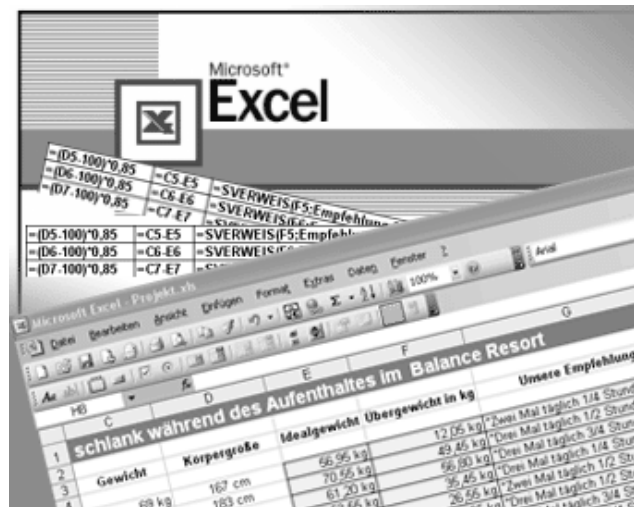
**Assessment by means of poster presentation and interview**



# Project

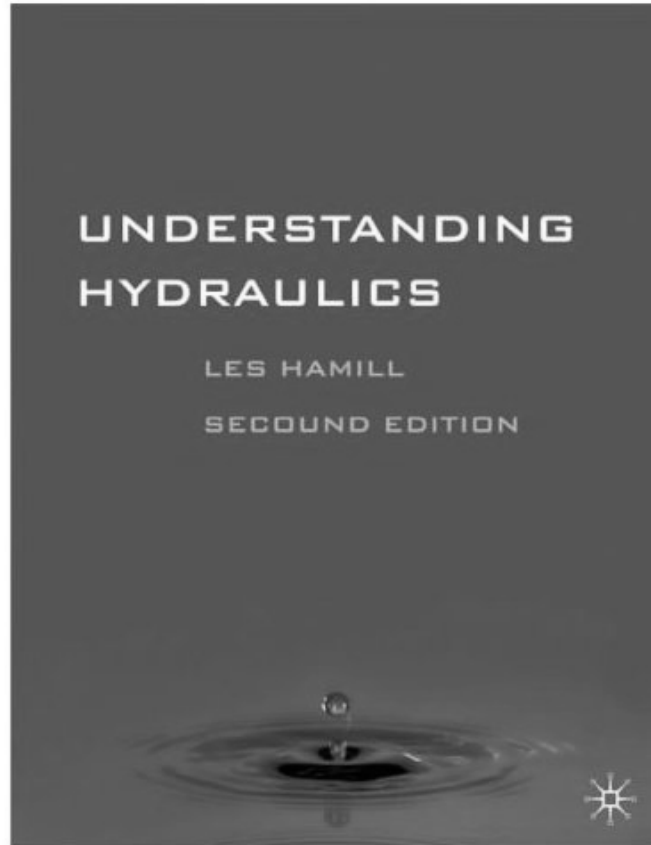
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- Start Week 3 in Tutorial/Lab Class
- You will need Computer access
- You need to know how to use excel



# Recommended Text Book

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- Hamill, L. (2001)
- Understanding Hydraulics, 2<sup>nd</sup> edition, Palgrave, Basingstoke; ISBN 0333779061
- Some in Library
- I have informed book store and publisher



# Assessment

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- **20 % Project Work**
  - Project portion is non repeatable
  - Late submissions will not be accepted
- **10 % Quiz**
  - The Quiz portion is non repeatable
  - Late submissions will not be accepted
- **70% Semester Examination**
  - Memory aids will not be allowed
- **All grades will be provided at the end of the year through official channels**



**Project Work and Quizzes are non repeatable**



# Repeats

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- **70% Semester Examination**
  - Four (4) questions,
  - Answer all four (4)
  - Two and half (2.5) hours
  
  - Memory aids will not be allowed

**Project work is non repeatable**



# Questions

