# ENGR H4505: Hydraulics I

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| **Module Title:** | Hydraulics I |
| **Language of Instruction:** | English |

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| **Credits:** | 10 |

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| **NFQ Level:** | 8 |

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| **Module Delivered In** | 2 programme(s) |

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| **Teaching & Learning Strategies:** | Lectures 90 hours; Project Work 20 hours; Practicals/ Site Visits 10 hours; Private Study 90 hours |

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| **Module Aim:** | The aims of this module are: to develop an understanding of the concepts of hydraulics; to equip students to solve problems in hydraulics; to prepare the students for further study in the area of hydraulic engineering, where fundamental principles can be applied in a practical way |

| **Learning Outcomes** | |
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| *On successful completion of this module the learner should be able to:* | |
| LO1 | Describe & examine (a) the properties of fluids (b) the scientific laws of fluids at rest. (c) the different flow characteristics & the concepts of fluids in motion. (d) the different types of flow measurement devices. (e) Newton's Laws of Motion. |
| LO2 | Derive & apply (a) expressions from the scientific laws of fluids at rest, to engineering problems, specifying underlying assumptions & limitations. (b) expressions from the concepts of fluids in motion, to broadly- defined engineering problems, specifying underlying assumptions & limitations (c) expressions for flow measurement devices, to broadly- defined engineering problems, specifying underlying assumptions & limitations. (d) the energy equation to broadly-defined pipeline problems, specifying underlying assumptions & limitations. |
| LO3 | Derive, apply & estimate the flow-rate to broadly-defined open channel problems, specifying underlying assumptions & limitations. |
| LO4 | Derive, apply & analyse (a) the flow in broadly-defined pipe network problems, specifying underlying assumptions & limitations. (b) the flow in broadly-defined pumped system problems, specifying underlying assumptions & limitations. |
| LO5 | Carry out tests and analyse & interpret data on fluids & hydraulic structures. |
| LO6 | Use appropriate software tools to present findings from tests on fluids & hydraulic structures. |

| **Pre-requisite learning** |
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| ***Module Recommendations***<br>*This is prior learning (or a practical skill) that is recommended before enrolment in this module.* |
| No recommendations listed |
| ***Incompatible Modules***<br>*These are modules which have learning outcomes that are too similar to the learning outcomes of this module.* |
| No incompatible modules listed |
| ***Co-requisite Modules*** |
| No Co-requisite modules listed |
| ***Requirements***<br>*This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.* |
| Bachelor of Engineering (Ordinary) in Civil Engineering |

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## Module Content & Assessment

| Indicative Content |
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| **Fluid Properties**<br>(a) Fluids Vs Solids (b) Newtonian & Non-Newtonian Fluids (c) Properties of Fluids |
| **Statics**<br>(a) Pascal's Law (b) Pressure measurement using manometers (c) Forces on Submerged Surfaces |
| **Fluid Dynamics**<br>(a) Flow Characteristics (b) Streamlines & Streamtubes (c) Fluids in Motion- Conservation of Mass, Energy and Momentum (d) Venturimeters & Orifices (e) Weirs and Notches |
| **Real Fluids**<br>(a) Laminar, Transitional & Turbulent Flows (b) Boundary Layers |
| **Flow of Water in Pipes**<br>(a) Ideal fluid flow in a piped system (b) Real Fluid flow in a piped system (c) Frictional head losses (d) Local Head losses |
| **Open Channel Flow**<br>(a) Types of Flow (b) Properties of Open Channels (c) Fundamental Equations (Conservation of Mass, Energy & Momentum) (d) Velocity Distribution in Open Channels (e) Laminar and Turbulent Flow (f) Critical, sub-critical and super-critical flow (g) Froude Number (h) Uniform Flow: (i) Application of Energy equation for Rapidly Varied Flow; (ii) Application of Momentum equation for Rapidly Varied Flow (i) Gradually Varied Flow: (i) Classification of profiles; (ii) How to determine the surface profile; (iii) Method of solution for the Gradually Varied Flow equation (j) Critical Depth Meters |
| **Pipe Network Analysis**<br>(a) Loop Method (b) Nodal Method (c) Matrix Method |
| **Pumps**<br>(a) Hydraulic gradient in pump-pipeline systems (b) Multiple pump systems (c) Variable speed pump operation (d) Suction lift limitations |

| Assessment Breakdown | % |
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| Project | 40.00% |
| End of Module Formal Examination | 60.00% |

No Continuous Assessment

| Project | | | | |
|---|---|---|---|---|
| *Assessment Type* | *Assessment Description* | *Outcome addressed* | *% of total* | *Assessment Date* |
| Project | No Description | 1,2,3,4,5,6 | 40.00 | n/a |

No Practical

| End of Module Formal Examination | | | | |
|---|---|---|---|---|
| *Assessment Type* | *Assessment Description* | *Outcome addressed* | *% of total* | *Assessment Date* |
| Formal Exam | No Description | 1,2,3,4 | 60.00 | End-of-Semester |

**SETU Carlow Campus reserves the right to alter the nature and timings of assessment**

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## Module Workload

| **Workload: Full Time** | | |
|---|---|---|
| *Workload Type* | *Frequency* | *Average Weekly Learner Workload* |
| Lecture | 30 Weeks per Stage | 3.00 |
| Estimated Learner Hours | 30 Weeks per Stage | 4.00 |
| | Total Hours | 210.00 |

## Module Delivered In

| Programme Code | Programme | Semester | Delivery |
|---|---|---|---|
| CW_CMHCE_B | Bachelor of Engineering (Honours) in Civil Engineering - Ab Initio | 5 | Mandatory |
| CW_CMCEN_B | Bachelor of Engineering (Honours) in Civil Engineering - Add On | 1 | Mandatory |