Module Descriptor Form

Civil and Environmental Engineering

CL216 - Hydraulics And Hydrology

Module Code	CL216	**Module Title**	Hydraulics And Hydrology				
Module Registrar	White, Prof Christopher J						
Other Staff Involved	Dr Kamila Nieradzinska (Lecturer)						
Credit Weighting	20	**Semester**	1/2	**Elective**	No	**Academic Level**	2
Pre-requisites							
Required for							

Module Format and Delivery (hours):

Lectures	Tutorials	Assignments	Labs	Private Study	Total
44	33	60	6	57	200

Educational Aim

This module aims to:

- Develop an understanding of the processes underlying catchment hydrology and establish the key drainage relationships of rainfall and runoff from a site.
- Develop understanding of applied hydraulics in civil engineering including simple examples of pipe and open channel flow and control structures.

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Syllabus

This module will teach the following:

- Hydrological cycle; homogeneous measurements; records with missing data
- Atmospheric water; Water vapour, Precipitation, Evapotranspiration
- Hydrologic Measurement of atmospheric water and surface water; rain gauges, calculation of catchment inflow from multiple rain gauges – Theissen polygons, isohyets
- Catchment water balance
- Catchment Hydrology: Precipitation; evaporation; overland flow; groundwater flow; rainfall and runoff analysis; the Unit Hydrograph; reservoir routing; flood frequency analysis.
- Storm Drainage systems and SUDs basic principles
- Flow Visualisation: streamlines, pathlines and stream tubes
- Conservation of Mass: Application of Conservation of Mass Principle to steady flow through pipes and nozzles, and the derivation of the Continuity Equation
- Conservation of Momentum: application of the Linear Momentum Equation to steady flow through a nozzle and the calculation of forces on pipe bends
- Bernoulli's Equation: application to steady flow through a pipe, and to a Water Siphon
- Properties of gases, liquids, vapours and speed of sound and Mach Number
- An introduction to pipe flow: flow classification and energy diagrams applied to water supply systems
- Flow Measuring Devices: Venturi meter, orifice plate and nozzle meter
- The Energy Equation for open and closed system
- Flow control by weirs and Venturi flumes: specific energy, specific energy diagrams and critical flow

Learning Outcomes

On Completion of the module, the student is expected to be able to:

LO: 1	Apply the hydrological cycle as a tool in analysing catchment hydrology using simple analytical techniques in order to undertake a range of design and calculation activities based on engineering hydrology, analysing spatially distributed rainfall, and appreciating the underlying relationships and uncertainties.
LO: 2	Undertake a range of design and calculation activities based on engineering hydrology, analysing real and synthetic rainfall-runoff relationships, surface runoff, ground water flows and appreciating the underlying relationships and uncertainties.
LO: 3	Apply conservation equations to flows in pipes & horizontal open channels.
LO: 4	Analyse simple flow measuring devices and control structures.

(UK SPEC suggests no more than 4 learning outcomes per module. Statements must be broad and be syllabus free and link in with the intended learning outcomes on the programme specifications.)

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Assessment of Learning Outcomes - Criteria

Learning Outcome: **1**

	Criteria
1	Detail the underlying principles and individual components of the hydrological cycle
2	Use catchment and environmental characteristics to determine contributions of hydrological cycle components
3	Ability to perform a basic catchment water balance
4	Detail methods to spatially distribute rainfall based on gauge data
5	Ability to spatially distribute and convert rain gauge data to estimate rainfall to a catchment

Learning Outcome: **2**

	Criteria
1	The ability to review, adjust and analyse basic hydrological data to convert rainfall to runoff
2	The ability to solve complex hydrological analyses to determine rainfall-runoff responses

Learning Outcome: **3**

	Criteria
1	Use of energy diagrams to describe a hydraulic system
2	Application of Bernoulli's equation to open channel & pipe flows
3	Calculation of forces on pipe bends and nozzles

Learning Outcome: **4**

	Criteria
1	Application of the principles of the Venturi meter and other flow measuring devices
2	Use of specific energy diagram to describe open channel flow
3	Applications of critical depth, for weirs and channel contractions

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Assessment Method(s) Including Percentage Breakdown and Duration of Exams

To Pass the module, students need to gain a summative mark of: 40%

Description	Semester	Start Week	Duration	Weight	Submission Week	Linked Criteria
Hydrology Quiz 1. Closed Book	1		1.00	1%	5	
Hydrology Quiz 2. Closed Book	1		1.00	1%	6	
Hydrology Quiz 3. Closed Book	1		1.00	1%	7	
Hydrology Quiz 4. Closed Book	1		1.00	1%	8	
Hydrology Quiz 5. Closed Book	1		1.00	1%	10	
Loch Katrine Group Project	1	3		15%	10	
Exam. Closed Book	1		2.00	30%	E	
Hydraulics Quiz 1. Closed Book	2		1.00	1%	2	
Hydraulics Quiz 2. Closed Book	2		1.00	1%	4	
Hydraulics Quiz 3. Closed Book	2		1.00	1%	8	
Lab report	2	4		12%	9	
Exam. Closed Book	2		2.00	35%	E	

Principles of Assessment Feedback

Principle 1: Assessment and feedback practices promote effective student learning:
1. Laboratory classes and coursework assignments are designed to focus student learning on key topics and learning material
2. Tutorial problems with answers to encourage and guide private study are provided.
3. Tutorial classes are held frequently for one-to-one interaction between instructors and students and timely feedback.

Principle 2: Assessment and feedback practices are appropriate, fair, and transparent:
1. All assignments and assessments combine straightforward and challenging tasks.
2. Model solutions are provided for some coursework assignments.

Principle 3: Assessment and feedback practices are clearly communicated to students and staff:
1. All assessed coursework assignments are open to view from the start of the course
2. All assessed coursework assignments are returned to students with feedback including annotations and comments.

Principle 4: Assessment and feedback practices are continuously reviewed:
1. Interim student feedback is taken during each semester to review progress and resolve current issues; final semester student feedback taken upon completion of lecture courses to monitor student experience.
2. Coursework assignment and examination marks reviewed at end of year to monitor attainment and compared to student experience.

Additional Information

Students need to gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-examined during the August diet. This re-examination will consist entirely of exam. Students who are absent from both exams will be returned as Absent.

Resit Procedure

Students who fail the module at the first attempt will need to resit an exam for each semester that they failed. If a student has failed both semesters (S1 & S2), then they will need to resit two exams, one for S1 material and another exam for S2 material, each accounting for 50%. Students must achieve a mark of 40% overall in the resit to pass the module. No marks from any previous attempts will be transferred to the resit attempt.

Semester 1 resit: 2-hour formal examination in August with same format as in December.
Semester 2 resit: 2-hour formal examination in August with same format as in May/June.

Recommended Reading

- ** EM Wilson, Engineering Hydrology, 4th Ed, Palgrave MacMillan
- * EM Shaw, Hydrology in Practice, 4th Ed. Routledge, Taylor Francis
- ** L Hamill, Understanding Hydraulics, 3rd Ed, Palgrave MacMillan
- * LJF Douglas, JM Gasiorek, JA Swaffield, LB Jack. Fluid Mechanics, Prentice Hall
- * YA Cengel, JM Cimbala. Fluid Mechanics, McGraw-Hill
- * Chadwick & Morfett. Hydraulics in Civil and Environmental Engineering, E&FN Spon
- * MC Potter, DC Wiggert and BH Ramadan, Mechanics of Fluids, Cengage Learning
- * Featherstone & Nalluri, Civil Engineering Hydraulics, BSP

***Purchase recommended **Highly recommended reading *For reference

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Module Timetable

Week	Semester 1	Semester 2
0		
1		
2		Test 1%
3		
4		Test 1%
5	Test 1%	
6	Test 1%	
7	Test 1%	
8	Test 1%	Test 1%
9		Submission 12%
10	Test 1%, Submission 15%	
11		
E	Examination 30%	Examination 35%

Date of Last Modification

10-09-2025