MODULE DESCRIPTION FORM

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CL216 Hydraulics and Hydrology

Module Registrar: Dr Chris White	**Taught To (Course):** Civil Engineering; Civil and Environmental Engineering		
Other Lecturers Involved: Miss Lou Brett; Mrs Sarah Lavery	**Credit Weighting:** 20	**Semester:** 1 & 2	
Assumed Prerequisites: CL132; CL134	**Compulsory/ ~~optional/ elective class~~**	**Academic Level:** UG Year 2	**Suitable for Exchange:** n/a

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project (group)	Assignments	Private Study	**Total**
44	33	6				30	30	57	200

Educational Aim

This course 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.

Learning Outcomes

On completion of the course the student is expected to be able to:

LO1- 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.

LO2- 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.

LO3- Apply conservation equations to flows in pipes & horizontal open channels.

LO4- 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.)

Syllabus

The course 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.

Assessment of Learning Outcomes

Criteria

For each of the Module Learning Outcomes the following criteria will be used to make judgements on student learning:

[Note: Criteria break the LO down into 'teachable' elements but do not become syllabus orientated i.e. no mention of CAD package names, components etc.]

LO1 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.
C1 Detail the underlying principles and individual components of the hydrological cycle
C2 Use catchment and environmental characteristics to determine contributions of hydrological cycle components
C3 Ability to perform a basic catchment water balance
C4 Detail methods to spatially distribute rainfall based on gauge data
C5 Ability to spatially distribute and convert rain gauge data to estimate rainfall to a catchment

LO2 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.
C1 The ability to review, adjust and analyse basic hydrological data to convert rainfall to runoff
C2 The ability to solve complex hydrological analyses to determine rainfall-runoff responses

LO3 Apply conservation equations to flows in pipes & horizontal open channels.
C1 Use of energy diagrams to describe a hydraulic system
C2 Application of Bernoulli's equation to open channel & pipe flows
C3 Calculation of forces on pipe bends and nozzles

LO4 Analyse flow measuring devices and control structures.
C1 Application of the principles of the Venturi meter and other flow measuring devices
C2 Use of specific energy diagram to describe open channel flow
C3 Applications of critical depth, for weirs and channel contractions

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at:
*https://www.strath.ac.uk/staff/policies/academic/*http://www.strath.ac.uk/learnteach/informationforstaff/staff/assessfeedback/12principles/
)

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.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams (Semester 1)

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	Dec	2 hrs	30%	5 quizzes	5%	1	15%
L/Outcomes	LO1/ LO2						LO1/LO2	

Indicate which learning outcomes (L01, L02 etc) are to be assessed by exam/coursework/project as required.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams (Semester 2)

	Examinations				Courseworks		Projects	
	Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***
	1	May	2 hrs	35%	3 quizzes	7.5%	1	7.5%
L/Outcomes	LO3/ LO4						LO3/LO4	

Coursework / Submissions deadlines (*academic weeks*):

Semester 1:

Mono Lake Coursework – submission due in week 10: 16:00 Thursday 24th November.

Online Quizzes – submissions due in weeks 5, 6, 8, 9 and 11.

Semester 2:

Channel Controls Lab Report – due in week 7 (for week 5 Lab Groups) and week 8 (for week 6 Lab Groups).

Online Quizzes due in weeks 6, 9 and 10.

Resit Assessment Procedures:

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

PLEASE NOTE:

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.

Recommended Reading

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

- ****** 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.

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No

Session:

Approved:

Course Director Signature:
Date of Last Modifications: August 2022

(Updated May 2018)

MODULE TIMETABLE

Module Code:	**CL216**	**Module Title:**	**Hydraulics and Hydrology**

Brief Description of Assessment:

Semester 1 (10 credits) - 5 quizzes (5%), coursework (15%), exam (30%)

Semester 2 (10 credits) - 3 quizzes (7.5%), individual lab report (7.5%) and exam (35% credits).

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
				Course-work release Quiz 1 handout	Quiz 2 handout	Quiz 3 handout Quiz 1 submission	Quiz 4 handout Quiz 2 submission		Quiz 3 submission	Quiz 5 handout Quiz 4 submission	Course-work submission	Quiz 5 submission	Exam (1)

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
					Quiz 1 handout	Lab handout (WK 5 group)	Lab handout (WK 6 group) Quiz 1 submission	Lab submission (WK 5 group) Quiz 2 handout	Lab submission (WK 6 group) Quiz 3 handout	Quiz 2 submission	Quiz 3 submission		Exam (2)