COURSE DESCRIPTOR 2021/22

CL420 Water Engineering 2

Course Registrar: Dr K Nieradzinska	**Taught To (Programme): UG Civil and Environmental Engineering**	
Other Lecturers Involved: Dr J. Minto	**Credit Weighting: 20crs**	**Semester: 1 + 2**
Assumed Pre-requisites: CL216 Hydraulics and Hydrology, CL315 Water Engineering 1	**Compulsory/ ~~optional/ elective course~~**	**Academic Level:**

Course Format and Delivery (hours):

Lecture	Tutorial	Laboratory	Project	Assignments	Private Study	**Total**
40	16	6	40	60	38	200

Course Aim(s)

This class aims to develop an understanding of a wide range of water engineering theory and processes including open channel flow, complex free surface flows, hydraulics structures and hydropower systems processes as well as the ability to undertake design calculations sufficient to produce a concept and detailed design of simple hydraulic structures and hydropower systems. In Semester 1 this class builds on the knowledge gained in Water Engineering 1 in terms of understanding the application of hydraulics to open channel flows. In Semester 2 this class builds on the knowledge gained in hydraulics, hydrology, and open channel flow by applying it to common water engineer processes such as structures for flow control and power generation, sediment transport and erosion, and flood risk management.

Learning Outcomes

On completion of the course the student is expected to be able to
LO1 Undertake calculations of basic hydraulic parameters (flow, head, velocity, depth) in open channels subject to uniform flows and use this information to optimise the channel conveyance and where, appropriate, develop suitable hydraulic modelling approaches for laboratory studies.

LO2 Undertake basic hydraulic calculations (involving flow, head, velocity, depth) for open channels subject to complex and changing free surface flows (steady non-uniform: GVF and RVF, unsteady flow).

LO3 Understand the role hydraulic structures systems can play in managing channel flows and undertake a range of simple calculations for common hydraulic assets based on an understanding of the hydraulic principles of operation for each asset and their operating opportunities and constraints.

LO4 Understand the role hydraulic modelling can play in representing river system behaviour and be able to undertake a range of simple design calculations and activities based on an understanding of the hydraulic principles of operation of river channels and hydraulics, additionally to understand how to control water flow in the channel.

Syllabus

The course will teach the following:

Semester 1 (CL420 & CL442)
Common hydraulic concepts, principles and systems
Channel conveyance and optimisation
Roughness and channel conveyance (flow forces and energy)
Complex flows including Gradually varied flow (GVF) in a channel and Rapidly varied channel flow (RVF) (specific force)
Compound Channels
Unsteady Free Surface Flows
Channel Controls

Semester 2 (CL420 & CL443)
River systems and flooding
Common Hydraulic structures including weirs, orifices and culverts
Design of stable channels
River engineering: modelling and engineering
An introduction to Hydraulic modelling

Programme Threads

Assessment Criteria

Thread	Primary	Secondary	Contributory
Design	**LO3, LO4**		**LO1, LO2**
Health, Safety & Risk Assessment	**LO4**	**LO1, LO2, LO3**	
Sustainability			**LO3, LO4**
Maths for Engineers	**LO1, LO2, LO3, LO4**		
Industry		**LO3, LO4**	**LO1, LO2**
Professional Skills	**LO3, LO4**	**LO1, LO2**	

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

LO1 Undertake calculations of basic hydraulic parameters (flow, head, velocity, depth) in open channels subject to uniform flows and use this information to optimise the channel conveyance and where, appropriate, develop suitable hydraulic modelling approaches for simple flow studies.
C1 The ability to identify common and relevant hydraulic concepts and relationships
C2 The ability to work with simple channel sections of fluid flow and open channel flow concepts
C3 The ability to estimate channel conveyance, optimise the channel shape and control channel flows/discharges

LO2 Undertake calculations of basic hydraulic parameters (flow, head, velocity, depth) in open channels subject to complex and changing free surface flows (non-uniform, GVF, RVF and unsteady flow)
C1 The ability to identify common and relevant hydraulic parameters
C2 The ability to identify and evaluate the controlling or dominant hydraulic components
C3 The ability to solve complex hydraulic calculations through identifying, resolving or balancing common terms or determining unknowns

LO3 Undertake a range of simple calculations for common hydraulic structures based on an understanding of the hydraulic principles of operation for each asset and the operating constraints they face.
C1 The ability to identify the function of common hydraulic structures and the role they play in the environment.
C2 The ability to identify and evaluate the relevant hydraulic parameters and assess the controlling or dominant hydraulic components, resolving equations based on these
C3 Design simple hydraulic structures based on hydraulic theory to achieve desired outcomes or effects on channel hydraulics.

LO4 Understand the role hydraulic modelling can play in representing river system behaviour and be able to undertake a range of simple design calculations and activities based on an understanding of the hydraulic principles of operation of river channels and hydraulics.
C1 The ability to identify and explain the function of the key components of river systems.
C2 The ability to conceptually design and hydraulically model river systems, including selection of appropriate hydraulic assets and model parameters.
C3 The ability to assess hydraulic modelling outputs, assess they hazards they may represent and the potential impacts of these on the environment.

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

Principles of Assessment and Feedback

see https://www.strath.ac.uk/staff/policies/academic/

Please state briefly how these are incorporated in this module.

Principles of Feedback are incorporated in class teaching and practical work through (1) provision of exemplar technical and lab reports to indicate and clarify levels of performance, (2) class examples to support student development of learning about the wider engineering community; (3) class laboratory pre-activity and post activity facilitates the development of self-assessment and reflection; (4) summative laboratory and technical assessments shape preparations of the subject areas for class exams.

Feedback is encouraged through frequent informal class/group/individual discussions with teaching staff and incorporated through formative assessment of both class and laboratory work. Student feedback is taken at regular opportunities to identify assessment timing and feedback dates where possible and to support shaping of teaching to suit perceived knowledge or experience gaps, closing any gap between current and desired knowledge or performance and encouraging students to spend time and effort on their learning.

Recommended Reading

Hamill. Understanding Hydraulics. 4th Ed. Palgrave
Chadwick & Morfett. Hydraulics in Civil and Environmental Engineering 3rd Ed. E & FN Spon.
Butler and Davies, Urban Drainage, 2nd Edition, SPON
Wilson, Engineering Hydrology, 4th Ed, Palgrave MacMillan
Chanson. The Hydraulics of Open Channel Flow. Arnold..
Massey. Mechanics of Fluids Chapman & Hall.
Novak, Moffat, Nalluri & Narayanan. Hydraulic Structures Unwin Hyman

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.

Resit Arrangements

Resit examinations will be held in the Summer resit diet. Coursework resubmissions at the discretion of the lecturer.

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.

NB: The August examination marks (50%) are combined with the coursework marks from Semesters 1 and 2 (50%). Students will be required to undertake both resit exams unless otherwise directed by the course director.

Approved

Programme Director Signature:
Date of Last Modifications:

(Updated September 2021)

Assessment and Feedback Schedule

Class Code	**CL420**	Class Title	**Water Engineering 2**

Brief Description of Assessment

Summative Assessment: 2 x 2hr Exams in the Semester 1 and 2 Exam Periods (25% each), 1 x Lab Coursework (15%), 6 x Quizzes (15%) + 1 x Design Exercise Reports (20%)

Formative Assessment: 2 x 3hr Class Laboratories & 5 x 2hr Design Project sessions, MyPlace activities

Indicate in the tables below the Hand-Out (H), Submission (S) and Feedback (F) dates for each lab report/coursework/project and the timing of each Exam/Class Test (E), (T). Include duration of exam in brackets (e.g. E (2)).

Semester 1

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
H41 / H43 Lab & CW	LO1, LO2	7.5	Group	H		LAB A	LAB B		S					F	
Presentation	LO1, LO2	7.5	Group								S			F	
Quizzes	LO1, LO2	10	Individual		H1S1	H2S2	H3S2	S1,S2	S3,H4	S4,H4				F1,2,3,4	
Exam	LO1, LO2	25	Individual												E (2)

Semester 2

Assessment type (& title)	LOs	Weight (%)	Individual / Group	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
Quizzes	LO3, LO4	5	Individual			H1	S1	H2	S2						
Flood Risk Project	LO3, LO4	20	Group			H				S1				S2, F	
Exam	LO3, LO4	25	Individual												E (2)

.Mapping Module Learning Outcomes to AHEP

Module Learning Outcome	**Engineering Council AHEP competencies: Knowledge, Understanding and Ability**
LO1 Undertake calculations of basic hydraulic parameters (flow, head, velocity, depth) in open channels subject to uniform flows and use this information to optimise the channel conveyance and where, appropriate, develop suitable hydraulic modelling approaches for simple flow studies.	**Integrated Masters (MEng) Degrees** • Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects. • Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques • Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects • Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader. • Ability to work with technical uncertainty **BEng (Hons) Degrees accredited as partially meeting the education requirement for CEng** • Understanding of engineering principles and the ability to apply them to analyse key engineering processes. • Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities • Ability to work with technical uncertainty
LO2 Undertake basic hydraulic calculations (involving flow, head, velocity, depth) for open channels subject to complex and changing free surface flows (steady non-uniform: GVF and RVF, unsteady flow).	**Integrated Masters (MEng) Degrees** • Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively • Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes. • Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques • Ability to work with technical uncertainty

	• Understanding of the use of technical literature and other information sources • Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) • Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader. • Apply their skills in problem solving, communication, working with others, information retrieval and the effective use of general IT facilities. **BEng (Hons) Degrees accredited as partially meeting the education requirement for CEng** • Understanding of engineering principles and the ability to apply them to analyse key engineering processes. • Understanding of, and the ability to work in, different roles within an engineering team. • Ability to work with technical uncertainty • Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques • Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities • Exercise initiative and personal responsibility, which may be as a team member or leader.
LO3 Undertake a range of simple calculations for common hydraulic structures based on an understanding of the hydraulic principles of operation for each asset and the operating constraints they face.	**Integrated Masters (MEng) Degrees** • Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively • Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes. • Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques • Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) • Ability to work with technical uncertainty

	• Understanding of the use of technical literature and other information sources • Apply their skills in problem solving, communication, working with others, information retrieval and the effective use of general IT facilities. **BEng (Hons) Degrees accredited as partially meeting the education requirement for CEng** • Understanding of engineering principles and the ability to apply them to analyse key engineering processes. • Understanding of, and the ability to work in, different roles within an engineering team. • Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities • Ability to work with technical uncertainty • Understanding of the use of technical literature and other information sources
LO4 Understand the role hydraulic modelling can play in representing river system behaviour and be able to undertake a range of simple design calculations and activities based on an understanding of the hydraulic principles of operation of river channels and hydraulics.	**Integrated Masters (MEng) Degrees** • Awareness of developing technologies related to own specialisation • A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations • Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes. • Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques • Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) • Ability to work with technical uncertainty • Understanding of the use of technical literature and other information sources • Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader. • Apply their skills in problem solving, communication, working with others, information retrieval and the effective use of general IT facilities. • Communicate their work to technical and non-technical audiences

	BEng (Hons) Degrees accredited as partially meeting the education requirement for CEng • Understanding of engineering principles and the ability to apply them to analyse key engineering processes. • Understanding of, and the ability to work in, different roles within an engineering team. • Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities • Exercise initiative and personal responsibility, which may be as a team member or leader. • Knowledge of characteristics of particular materials, equipment, processes, or products • Ability to apply relevant practical and laboratory skills • Understanding of the use of technical literature and other information sources

JBM Programme Threads

Thread	Primary	Secondary	Contributory
Design	**X**		
Health, Safety & Risk Assessment			**X**
Sustainability			
Maths for Engineers	**X**		
Industrial Engagement			
Digital Technologies	**X**		