School of Civil and Environmental Engineering

Term 1, 2020

CVEN9611 URBAN HYDROLOGY (SHORT COURSE)

COURSE DETAILS

Units of Credit	6
Contact hours	6 day short course, 9am – 5pm each day, 26 - 28 February and 2 - 4 March 2019
Class location	CE 501, Civil Engineering Building (H20) - Wednesdays 26 February and 4 March CE 701, Civil Engineering Building (H20) – 27 & 28 February and 2 March ***Field trip – Tuesday 3rd March***
Course Coordinator and Lecturer	Dr Stefan Felder email: s.felder@unsw.edu.au office: Water Research Laboratory/Room CE 303 phone: 8071 9861 (Water Research Laboratory) or 9385 5898 (UNSW)
Lecturer	Dr Kefeng Zhang email: kefeng.zhang@unsw.edu.au office: Valentine Annex 139 phone: 9385 5227 Dr Clare Stephens email: clare.stephens@unsw.edu.au office: Valentine Annex 131 Dr Veljko Prodanovic email: v.prodanovic@unsw.edu.au office: Valentine Annex 139 phone: 9385 4368 Dr Behzad Jamali email: b.jamali@unsw.edu.au office: Valentine Annex 139 phone: 9385 5227

INFORMATION ABOUT THE COURSE

This course provides students with the skills to assess and design for human impacts on the hydrological

cycle, specifically focusing on impacts of urban development on stormwater quantity and quality. The course covers the management of urban stormwater including re-use and groundwater interaction; design of stormwater quantity and quality management structures including detention basins, retention basins, infiltration basins, gross pollutant traps, sedimentation basins, biofilters and constructed wetlands.

The assumed knowledge for this course is undergraduate Civil and Environmental hydrology, fluid mechanics and hydraulics. Students who do not have this assumed knowledge should have completed CVEN9625 Fundamentals of Water Engineering. If you have concerns about your background knowledge, please contact the course coordinator.

HANDBOOK DESCRIPTION

See link to virtual handbook*:*

http://www.handbook.unsw.edu.au/postgraduate/courses/2020/CVEN9611.html

OBJECTIVES

The objectives of the course are:

1. To provide an overview of urban hydrology and stormwater management. Included in the course are an introduction to human impact on the hydrological cycle, anthropogenic influences on the quantity and quality of stormwater runoff from urban catchments and case studies in urban stormwater management. Application of the continuity, energy and momentum principles of the analysis of flows in different scenarios.
2. To characterise the most important types of stormwater infrastructure used in urban drainage systems. Methods for their design as well as current issues in stormwater management are presented and discussed.

These objectives link to the following program outcomes:

- An in-depth engagement with the relevant disciplinary knowledge in its inter-disciplinary context
- Capacity for analytical and critical thinking and for creative problem solving
- Ability to engage independent and reflective learning
- Information literacy
- Skills for effective communication

TEACHING STRATEGIES

Detailed lecture notes with examples will be supplied via Moodle for this course. The purpose is to free up your time to think and understand during lectures.

Please note that all lecture and workshop materials for this course will be distributed electronically via Moodle. No paper copies will be supplied in class. It is essential that students download and bring to class printed and/or electronic copies of all the materials. Students will also require a calculator for all classes.

The following teaching strategies will be used in the course:

Private Study	• Review lecture material • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle

Lectures	• Find out what you must learn • Learn and discuss course content • Follow worked examples • Hear announcements on course changes
Workshops	• Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Field trip	• Practical demonstration of course theory, to set studies in context • Centennial Park – practical application of stormwater management • WRL- Presentations of engineering applications by WRL engineers and inspection of physical models
`Laboratory	• Demonstration of culvert hydraulics

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

	Learning Outcome	**EA Stage 1 Competencies**
1.	*Understand and analyse the impacts of urbanisation on stormwater quantity and quality*	*PE1.1, PE1.3, PE1.4,*
2.	*Perform calculations to estimate peak flows and volumes of stormwater*	*PE2.1, PE2.2*
3.	*Describe the main pollutants in urban stormwater and methods for their removal*	*PE1.1, PE1.3*
4.	*Understand the important characteristics of basic hydraulic and water quality structures in open channel flows and pipes*	*PE1.2, PE1.3, PE1.5*
5.	*Perform calculations and design of basic hydraulic and water quality structures in open channel flows and pipes*	*PE2.1, PE2.2, PE2.3*
6.	*Observe and understand real-life water engineering infrastructure and being able to critically assess hydraulic structures.*	*PE1.5, PE1.6, PE3.1, PE3.2*

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

ASSESSMENT

The assessment tasks for this course have been developed to assess each student's achievements in terms of each of the five learning outcomes listed above.

Assignments are individual assessments testing the students' understanding of the hydrological, hydraulic and water quality concepts in agreement with the learning objectives.

The final course mark will be based on you completing the coursework and final examination:

(i) your coursework mark accounts for 40% of the course, **and**
(ii) your final examination mark accounts for 60% of the course.

Provided a mark of 40% or more has been achieved in your final exam **and** a mark of 40% or more has been achieved in your coursework component, your final aggregated mark for this course will normally be based on

the sum of the scores from each of the assessment tasks with your final examination being worth **60%** of the final mark and your class work being **40%** of the final mark.

Students who perform poorly in the assignments are recommended to discuss progress with the lecturer. Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Assessment Task	Assessment Details	Due Date
Assignment 1 Online Pre-Task (5%)	Hydrological modelling	5pm, 9th March
Assignment 1 (10%)	Hydrological modelling	5 pm, 20th March
Assignment 2 (15%)	Hydraulics	5 pm, 3rd April
Assignment 3 (10%)	Biofilter design	5 pm, 17th April
Exam (60%)	2 hour exam covering material from the course.	During UNSW Term 1 examination period.

Late work will be penalised at the rate of 10% per day after the due time and date have expired.

Supplementary Examinations for Term 1 2020 will be held on Monday 25th May – Friday 29th May (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

All Distance/Short course mode students are expected to sit their final examination on Kensington campus (Sydney). If you reside further than 40 Km from the Kensington campus, and you wish to sit your exam externally (by distance), you must register for an external exam by the UNIVERSITY CENSUS DATE (Term 1: 15th March; Term 2: 28th June, Term 3: 11th October) more information found here

COURSE PROGRAM

The course schedule tabulated below shows the main topics and approximately how long will be spent on each topic. The schedule of lectures and site visits is outlined in the table below. Topics and the presenting lecturer are shown. Workshops will be held each morning and afternoon generally following the lecture material.

TERM 1, 2020

Time and Day	Topic	Lecturer	Assessments/ Notes
Wed 26 February	**Week 2**		
9:00 - 12:30	Urbanisation, design philosophies	CS	
12:30 - 13:30	Lunch		
13:30 - 17:00	Design events, Monte Carlo approaches and continuous simulation	CS	
Thu 27 February	**Week 2**		
9:00 -11:00	Flow routing methods	CS	
11:00-12:30	Stormwater quality	KZ	
12:30 - 13:30	Lunch		
13:30 - 17:00	Stormwater management principles & Introduction to Water Sensitive Urban Design	KZ	
Fri 28 February	**Week 2**		

Time and Day	Topic	Lecturer	Assessments/ Notes
9:00 - 12:30	Design of conveyance infrastructure	SF	
12:30 - 13:30	Lunch		
13:30 - 17:00	Stormwater treatment systems 1	VP	
Mon 2 March	**Week 3**		
9:00 - 12:30	Stormwater treatment systems 2	VP	Assignment "Biofilter design" issued
12:30 - 13:30	Lunch		
13:30 - 17:00	Culverts	SF	Wear closed shoes
Tues 3 March	**Week 3**		
9:00 - 13:30	Site visit to WRL – Demonstration of physical models and Guest Lectures	SF	Transport to WRL by coach from Gate 14 UNSW (Barker Street) Wear closed and comfortable shoes
13:30 - 14:30	Lunch at WRL		Bring your lunch – there are no shops near WRL
14:30 - 17:00	Site visit to Centennial Park Return to UNSW (walking) or leave directly from Centennial Park	SF	Wear clothing appropriate to weather. Assignment "Hydraulics" issued
Wed 4 March	**Week 3**		
9:00 - 11:00	WSUD benefits for flooding mitigation	BJ	
11:00 – 12:30	Introduction to computer modelling	CS / BJ	Assignment "Hydrological modelling" issued
12:30 - 13:30	Lunch		
13:30 - 17:00	Practice session computer modelling	CS / BJ	

ASSESSMENT OVERVIEW

Item	Weighting	Learning outcomes assessed	Assessment Criteria	Due date	Deadline for absolute fail	Marks returned
Assignment 1 Online Pre-task (Hydrological modelling)	5%	1,2	This online pre-task will help you to review the concepts required to complete Assignment 1	Monday 9th March Week 4	Friday 13th March Week 4	Immediately via online marking
Assignment 1 (Hydrological modelling)	10%	1,2	Students are expected to demonstrate their understanding of hydrologic modelling and impacts of urbanisation by performing calculations, designing a detention basin, running suitable models and explaining basic concepts. The marking of the assignment will be based upon the standard of the report, practical design strategy and the accuracy of the simulations and calculations.	Friday 20th March Week 5	Friday 27th March Week 6	Friday 3rd April Week 7
Assignment 2 (Hydraulics)	15%	1,4,5,6	Students are expected to demonstrate their understanding of engineering design and functionality of hydraulic structures in the context of urban hydrology. Students are also expected to demonstrate their ability to critically assess urban stormwater systems. The marking of the assignment will be based upon the standard of the report, the accuracy of their work and their critical assessment. In the second part of the assignment, students are expected to demonstrate their ability to undertake detailed hydraulic computations either by hand or using computer calculations with appropriate documentation of their working. Marks will be awarded for correct methods, calculations and clear setting out.	Friday 3rd April Week 7	Friday 10th April Week 8	Friday 17th April Week 9
Assignment 2 (Biofilter design)	10%	1,4,5	Students are expected to demonstrate understanding of engineering design of a biofiltration system used for stormwater pollution and/or flow reduction (based on specific	Friday 17th April Week 9	Friday 24th April Week 10	Friday 1st May Week 11

			requirement). Students will be asked to perform calculation in order to size different elements of biofiltration system, with additional understanding and description of the choice of plants for such system. The marking of the assignment will be based upon the standard of the report, the accuracy of calculation and their critical assessment of the overall system.			
4. Final exam (2 hours)	60% of final marks	1,2,3,4,5	Students are expected to demonstrate their understanding of hydrological modelling, urbanisation and the design of basic hydraulic structures and water quality improvement structures by performing calculations, drawings and explaining basic concepts.	During UNSW Session 1 examinations period.	N/A.	During formal notification of final results as determined by UNSW Faculty of Engineering.

RELEVANT RESOURCES

There is no textbook for this course but a number of recommended reference books for this course are indicated below - there will be further recommended reading indicated within the lecture notes and course delivery

- Akan, AO, (2006) Open Channel Hydraulics, Butterworth-Heineman
- Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia), 2016.(available from http://arr.ga.gov.au/arr-guideline)
- Chow, VT, (1959) Open Channel Hydraulics, McGraw-Hill Book Co, Tokyo, Japan
- French, RH, (1986) Open Channel Hydraulics, McGraw-Hill Book Co, Singapore
- Henderson, FM, (1966) Open Channel Flow, Macmillan Publishing Co, Inc, New York, NY, USA
- Jain, SC, (2001) Open-Channel Flow, John Wiley
- Ladson, T, (2005) Hydrology - An Australian Introduction. Oxford University Press, South Melbourne
- Stephenson, D, (1981), Stormwater Hydrology and Drainage, Elsevier, Amsterdam, Holland
- Sturm, TW, (2001) Open Channel Hydraulics, McGraw-Hill
- Urbonas, B and Stahre, P, (1993), Stormwater – Best management practices and detention for water quality, drainage, and CSO management, PRT Prentice Hall, Englewood Cliffs, NJ, USA:
- Wanielista, MP, (1978), Stormwater Management: Quantity and Quality, Ann Arbor Science Publishers, Ann Arbor, Michigan, USA
- Melbourne Water, 2005. WSUD Engineering Procedures: Stormwater. CSIRO Publishing.
- Payne, E.G.I., Hatt, B.E., Deletic, A., Dobbie, M.F., McCarthy, D.T. and Chandrasena, G.I., 2015. Adoption guidelines for Stormwater Biofilter systems (Version 2). Cooperatove Research Centre for Water Sensitive Cities, Melbourne, Australia.

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

PLAGIARISM

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

https://student.unsw.edu.au/plagiarism

ACADEMIC ADVICE

(Formerly known as Common School Information)

For information about:

- Notes on assessments and plagiarism,
- School policy on Supplementary exams,
- Special Considerations: student.unsw.edu.au/special-consideration
- Solutions to Problems,

- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC.

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and management of engineering projects
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (professional and lay domains)
	PE3.3 Creative, innovative and pro-active demeanour
	PE3.4 Professional use and management of information
	PE3.5 Orderly management of self, and professional conduct
	PE3.6 Effective team membership and team leadership