CVEN9625

Fundamentals of Water Engineering

Term 1, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Kefeng Zhang	kefeng.zhang@unsw.edu.au	Teaching Consultation Tuesday 4-5 pm	Vallentine Annexe (H22), Room 139, Water Research Centre, UNSW Kensington Campus	+61293855072

School Contact Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Course Details

Units of Credit 6

Summary of the Course

This course introduces the basic principles of Water Engineering with a focus on hydrology and hydraulics. The hydrology part introduces the hydrological cycle, rainfall and streamflow, evaporation, storm runoff and loss rates, rainfall estimation - IFD diagrams and design hyetographs, design flood estimation, deterministic rational method, time area method and rainfall-runoff modelling. The hydraulics part includes the properties of fluids, hydrostatics, mass conservation, energy and momentum in flowing fluids, pipes and open channel flow.

Course Aims

This is a fundamentals of water engineering course to equip qualified environmental scientists and other professionals who wish to work in professional water engineering, hydraulics, engineering hydrology, and environmental engineering.

The objective of this course is to provide an postgraduate level introduction to the practice of water engineering, including the hydrological cycle, rainfall and streamflow, evaporation, storm runoff and loss rates, rainfall estimation - IFD diagrams and design hyetographs, design flood estimation, deterministic rational method, time area method and rainfall-runoff modelling; the properties of fluids, hydrostatics, mass conservation, energy and momentum in flowing fluids, pipes and open channel flow.

Course Learning Outcomes

1. Conduct a hydrological assessment of a catchment
2. Quantify the size of design floods
3. Describe energy fluxes and calculate evaporation
4. Describe the properties of fluids and how these relate to fluid flow
5. Explain the fundamental principles of fluid flow in pipes and free surface flows namely continuity, energy and momentum, and to know when they can be applied to different flow scenarios
6. Calculate the flows through pipes and channels
7. Describe the engineering techniques used to analyse and design the basic components of hydraulic systems

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown in the table below.

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

Learning Outcome		**EA Stage 1 Competencies**
1.	*Conduct a hydrological assessment of a catchment.*	*PE1.1, PE1.5, PE2.2,PE2.3*
2.	*Quantify the size of design floods.*	*PE1.2, PE2.2, PE2.3*
3.	*Understand energy fluxes and calculate evaporation.*	*PE1.2, PE2.2, PE2.3*
4.	*Explain the basic properties of fluids and how these relate to fluid flow.*	*PE1.1, PE2.2, PE2.3, PE3.3*
5.	*Explain the fundamental principles of fluid flow in pipes and free surface flows via continuity, energy and momentum equations, and to know when they can be applied to different flow scenarios.*	*PE1.1, PE2.2, PE2.3, PE3.3*

6.	*Assess and carry out calculations on the flows through pipes and channels.*	*PE1.2, PE2.2, PE2.3*
7.	*By the conclusion of this course the student will be familiar with the engineering techniques used to analyse and design the basic components of water engineering.*	*PE2.2, PE2.3, PE3.3*

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

Teaching Strategies

Private Study

- Review lecture material and research literature
- Do set problems and assignments
- Reflect on class problems, assignments & literature review
- Do internet and library searches on topics related to the course
- Participate in class discussions
- Utilize material taught in class and learnt from literature review, to develop innovative solutions for the class project

Lectures

- Find out what you must learn
- Follow worked theory and examples
- Hear announcements on course changes

Workshops

- Be guided by demonstrators
- Practice solving set problems
- Ask questions

Assessments (quizs, examinations, assignments)

- Demonstrate your knowledge and skills
- Demonstrate higher understanding and problem solving

Additional Course Information

If a flood happens, how many people could lose their lives and how much damage could happen to infrastructure? Is it possible to predict a flood? How does climate change affect floods? How can water be guided/transferred from one location to another? The answer to these questions and the way to approach them lies within the Water Engineering discipline. This course will introduce the basic principles of Water Engineering with a focus on hydrology and hydraulics. You will learn about the movement of water on earth (hydrological cycle), what makes water flow, how water is transferred to desired locations through engineering (hydraulics) and how water behaves in natural and human made environments. This course will introduce you the basic principles of water engineering and enable you to apply your understandings to develop solutions to water engineering problems.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online Quiz (weeks 1-5,7-10)	10%	Must be completed by 11 pm of the day it is released	1, 2, 3, 4, 5, 6, 7
2. Assignment 1	15%	20/03/2023 11:00 PM	1, 2, 3
3. Assignment 2	15%	21/04/2022 11:00 PM	4, 5, 6, 7
4. Final Exam	60%	See Exam timetable	1, 2, 3, 4, 5, 6, 7

Assessment 1: Online Quiz (weeks 1-5,7-10)

Start date: Opens at 3 pm Mondays after each class (except for Week 9)
Submission notes: Online submission via Moodle
Due date: Must be completed by 11 pm of the day it is released
Marks returned: Marks returned each week after submission.

Weekly online quiz after lecture to review the material covered in the week.

Assessment criteria

Correct answers recieve full marks. Incorrect attempts prompt a comment and one additional attempt provide to correct the answer.

Additional details

See Moodle for more details of each Quiz.

Assessment 2: Assignment 1

Start date: 13/02/2023 03:00 PM
Submission notes: See Moodle for submission details
Due date: 20/03/2023 11:00 PM

This assessment is designed to assess your knowledge of applied hydrology to estimate evaporation, design rainfall, rainfall losses and design floods.

Assessment criteria

Correct answers are awarded full marks.

Presentation marks associated with parts requiring discussion.

Blind inclusion of calculations without adequate description or discussion is not preferred, and if needed, should be placed in an appendix with relevant results extracted and reported in the main body of the submission with discussion and comments.

Additional details

Students are expected to provide brief and to the point answers to the questions. A brief discussion on the distribution fitting and the selection of appropriate distribution is expected. If, some information is missing or not clear, it should be stated clearly in the assignment. The assessment will broadly be based on your understanding of the subject and answers to the questions.

Assessment 3: Assignment 2

Start date: 27/03/2023 03:00 PM
Submission notes: Submissions will be via Moodle
Due date: 21/04/2022 11:00 PM
Marks returned: End of Term

This assignment consists of a series of questions from the hydraulic lectures to assess your knowledge and techniques to quantify energy losses and flows through pipes and channels.

This is not a Turnitin assignment

Assessment criteria

Questions will be assessed against their understanding of the theory of fluid flow and the associated assumptions in the applying the theory. The assignment will consist of a series of calculations and students are expected to provide brief and to the point answers to the questions asked. The assessment will be broadly based on their understanding of the subject and answers to the questions asked.

Additional details

Students are expected to provide brief and to the point answers to the questions asked. The assessment will broadly be based on their understanding of the subject and answers to the questions asked.
Students will be assessed against their understanding of the theory of fluid flow and the associated assumptions in applying the theory.

Assessment 4: Final Exam

Start date: See Exam timetable
Submission notes: See Moodle for details including exam date
Due date: See Exam timetable

Examination of the entire material covered in the course

Hurdle requirement

A mark of at least 40% in the final examination is required before the class work is included in the final mark.

Attendance Requirements

For courses with Workshops and/or Labs, attendance for those classes is a necessary part of the course. You must **attend at least 80% of the workshop/lab** in which you are enrolled for the duration of the session.

Course Schedule

A table of lectures and workshops or practical class topics for each week is provided below. This table indicates the name of lecturer involved (where multiple lecturers teaching in course), online activities, such as discussion forums, and relevant readings from textbook and other reference material identified for the course. Class will be held every Monday (wk1-5, 7-8,10) from 12-3pm with workshops running for an hour immediately thereafter (3-4 pm in person) / (4-5 online, consent required for online workshops).

Date (week commencing)	**Lecture Content**	**Assignment**
13/02/2023 (Week 1)	Introduction to Australian hydrology and catchment processes Rainfall and streamflow measurement technique Introduction to Evaporation	Online quiz 1 Assignment 1 issued
20/02/2023 (Week 2)	Evaporation (continued) Energy balance Climate variability and anthropogenic climate change	Online quiz 2
27/02/2023 (Week 3)	Design storms, IFDs, losses, temporal patterns	Online quiz 3
06/03/2023 (Week 4)	Design flood estimation (flood frequency analysis) Rational method Time area method	Online quiz 4
13/03/2023 (Week 5)	Rainfall-runoff modelling	Online quiz 5
20/03/2023 (Week 6)	***Non□teaching week for all courses***	Assignment 1 due 20/03/23 (11pm)
27/03/2023 (Week 7)	(Start of Hydraulics) Properties of fluids	Online quiz 6 Assignment 2 issued

	Hydrostatics Hydrodynamics (Continuity)	
03/04/2023 (Week 8)	Hydrodynamics (Energy) Hydrodynamics (Momentum)	Online quiz 7
10/04/2023 (Week 9)	Drag force Pipe flow (*Note: due to Easter Monday holiday, pre-recorded lecture and workshop videos will be made available on Monday 10/04/2023)*)	Online quiz 8
17/04/2023 (Week 10)	Uniform flow Critical flow Hydraulic jump	Online quiz 9 Assignment 2 due 21/04/23 (11pm)

View class timetable

Timetable

Date	Type	Content
Week 6: 20 March - 24 March	Assessment	Assignment 1: See Moodle for submission details

Resources

Recommended 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

- 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)
- Pilgrim, D.H (Editor) (1998). Australian Rainfall & Runoff – A Guide to Flood Estimation. Institution of Engineers, Australia, Barton, ACT. ISBN: 1858256878 (Vol 1) and ISBN: 0858254352 (Vol 2)
- Ladson, A. (2008). Hydrology - An Australian Introduction. Oxford University Press, South Melbourne, ISBN: 978019555358
- Maidment, D.R (1993). Handbook of Hydrology. McGraw-Hill. ISBN: 9780070397323
- White, F.M. (2011). Fluid Mechanics, 7th edition, McGraw-Hill, ISBN 978 07 1286 459.
- Chanson, H. (1999). The Hydraulics of Open Channel Flow, Arnold, ISBN 0 340 74067 1
- Akan, A.O. (2006). Open Channel Hydraulics, Butterworth-Heinemann, ISBN 978 0 7506 6857 6.

Laboratory Workshop Information

Workshops will be held on Mondays of every teaching week , one in person immediately after the lecturer (3-4 pm), and one online after that (4-5 pm, consent required for online workshops).

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Academic Honesty and 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 Information

Final Examinations:

Final Exams in T1 2023 will be held on campus between the 28th of April and the11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw
- Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): https://intranet.civeng.unsw.edu.au/student-intranet
- Student Life at CVEN, including Student Societies: https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: The Nucleus: Student Hub
- Book an Academic Advising session: https://unswengacademicadvising.as.me/schedule.php

Disclaimer

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Mike Gal.

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Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.