School of Civil and Environmental Engineering

Term 1, 2021

CVEN9625 FUNDAMENTALS OF WATER ENGINEERING

COURSE DETAILS

Units of Credit	6
Contact hours	4 hours per week
Class	Mon, 14:00 - 17:00 Online
Workshop	Mon, 17:00 - 18:00 Online
Course Coordinators and lectures	Prof. Ashish Sharma (AS) email: a.sharma@unsw.edu.au office: School of Civil and Environmental Engineering, Kensington CE307 phone: 9385 5768 A/Prof. William Glamore (WG) email: w.glamore@unsw.edu.au office: UNSW Water Research Laboratory Manly Vale Campus phone: 9949 4188

INFORMATION ABOUT THE COURSE

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.

HANDBOOK DESCRIPTION

See link to virtual handbook:

https://www.handbook.unsw.edu.au/postgraduate/courses/2021/cven9625/

OBJECTIVES

The objectives of this course are:

- to provide an overview of surface water hydrology and the atmospheric processes that lead to

variability/change in rainfall and hence streamflow; and
- to provide an understanding of the rationale behind design flood estimation in hydrology.
- to introduce you to the theory of steady state closed conduit or pipe flows (i.e. pressurised flows) and free surface flows (open to the atmosphere).
- to give you an understanding of the properties of fluids, hydrostatics and the principles of fluid flow based on mass, energy and momentum.
- to enable you to apply the principles of fluid flow to different flow scenarios; to quantify energy losses due to pipe friction, pipe fittings and channel roughness for laminar and turbulent flows.
- to introduce you to the theory of channel transitions, rapidly varied flows and gradually varied flows.

Generally, the final exam and the assignments are designed to assess:

- Your understanding of the principles of Water Engineering

The course objectives, content and assessment focuses on encouraging the following attributes in you, with particular application to water engineering:

- Capacity for analytical and critical thinking and for creative problem solving. You will be exposed to, and be required to solve, numerous hydrologic problems in the Lectures, the workshops and the assignments --- “the learning is in the doing”. All these problems will cover a variety of scenarios, and where possible, will be drawn from engineering practice.
- Skills for effective communication: Throughout this course, the skills to be developed are in written communication. In your assignments and exam it is important that you clearly communicate your knowledge.
- Ability to engage independent and reflective learning: By revising the material from the lectures and the workshops you will gain improved skills in independent learning.

TEACHING STRATEGIES

Teaching in this course is centred on the lectures which are technical in content. You will develop your analysis skills in water engineering by applying the theory to problems which you undertake in the workshops. Detailed lecture notes will be provided. The purpose is to free up your time to think and comprehend during the lectures.

Private Study	• Review lecture material and textbook • 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 • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by demonstrators • Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving
Laboratory Work	• Hands-on work, to set studies in context

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 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.

COURSE PROGRAM

A table of lectures and workshops or practical class topics for each week, indicating 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.

Term 1 2020

Date (week commencing)	Lecture Content	Lecturer	Assignment
15/02/2021 (Week 1)	Introduction to Australian hydrology and catchment processes, rainfall and streamflow measurement technique; Introduction to Evaporation	AS	Assignment 1 issued
22/02/2021 (Week 2)	Evaporation (continued); Energy balance, climate variability and anthropogenic climate change	AS	
01/03/2021 (Week 3)	Design storms, losses, temporal patterns	AS	Assignment 1 due 07/03/21 (10pm)
08/03/2021 (Week 4)	Flood frequency analysis, rational method, time area method	AS	Assignment 2 issued
15/03/2021 (Week 5)	Rainfall-runoff modelling (1.5 hr)	AS	
22/03/2021 (Week 6)	***Non-teaching week for all courses***		Assignment 2 due 22/03/21 (10pm)
29/03/2021 (Week 7)	Properties of fluids Hydrostatics Hydrodynamics (Continuity – 1 and 2)	WG	
05/04/2021 (Week 8)	Hydrodynamics (Energy) Hydrodynamics (Momentum)	WG	
12/04/2021 (Week 9)	Hydrodynamics (Momentum) Drag force Pipe flow	WG	Assignment 3 issued
19/04/2021 (Week 10)	Uniform flow critical flow hydraulic jump	WG	

ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 60% of the Final Mark if class work is included and 100% if class work is not included. A mark of at least 40% in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned.

Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

These assessments are designed to assess your technical ability and engineering judgement towards problem solving with appropriate assumptions if required. These confirm that you are on right track and have developed correct professional aptitude. Details of each assessment component, the marks assigned to it and the dates of submission are set out below.

Item	**Length**	**Weight**	**Learning outcomes assessed**	**Assessment Criteria** *(this needs to explicitly describe what students are expected to demonstrate in the task)*	**Issue date**	**Due date and submission requirements**	**Marks returned**
Assignment1:Evaporation	2 weeks	10%	This assessment will assess how well you have grasped the fundamentals of hydrology and various components of the hydrologic cycle including evaporation.	Students are expected to provide brief and to point answers to the questions. 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. You are expected to justify the reason for going for a particular evaporation model.	15/02/21	Assignment 1 due 07/03/21 (10pm) Please submit via Moodle turnitin	14/03/21
Assignment 2: Flood frequency and IFDs value	2 weeks	10%	This assessment is designed to assess your knowledge of applied hydrology to estimate design rainfall, rainfall losses and design floods	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.	08/03/21	Assignment 2 due 22/03/21 (10pm) Please submit via Moodle turnitin	08/04/21
Assignment 3: Hydraulics	2 weeks	20%	Assessing your knowledge hydraulics and the techniques used to quantify energy losses and flows through pipes and channels.	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.	12/04/21	By midnight 27/04/21 Please submit via Moodle turnitin	End of term

SUPPLEMENTARY EXAMINATIONS

Supplementary Examinations for Term 1 2021 will be held in May 2021 (as advised by UNSW) 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.

PENALTIES

Penalties for late submissions will be accounted for. More specifically, late assignments will be penalised at the rate of 10% per day after the due time and date have expired.

FINAL EXAMINATION

Final examination will be held in the University examination period (Closed book, 2 hours duration) and has a value of 60% of the total mark; **You will be advised on how to appear in the exam as the term progresses.**

The final exam will assess your knowledge of the hydrological assessment of a catchment, estimation of design floods, evaporation, basic fluid properties, fluid flow in pipes and channels.

Short Course/Distance Courses:

"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"

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

- 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.

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

SPECIAL CONSIDERATION

For information about:

- Requesting Extension,
- Applying for Special Consideration

Refer to the University website at:
https://student.unsw.edu.au/special-consideration

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