# CVEN3501

## Water Resources Engineering

Term 1, 2022

# Course Overview

## Staff Contact Details

### Convenors

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Ashish Sharma | a.sharma@unsw.edu.au | Teaching Consultation Tuesday 4-5 | CVEN307 | +61425332304 |

### Lecturers

| Name | Email | Availability | Location | Phone |
|---|---|---|---|---|
| Martin Anderson | m.andersen@unsw.edu.au | | | |

## 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

The object of CVEN3501 is to introduce engineering hydrology and its application in water resources management and flood estimation. Topics discussed include hydrological cycle, climatology, atmospheric circulation, meteorological measurements, precipitation, interpretation of data, streamflow measurement, runoff components, hydrograph analysis, storm runoff and loss rates, rainfall estimation - IFD diagrams and design hyetographs, concepts of flood estimation, deterministic rational method, probabilistic rational method, time-area methods, unit hydrographs concepts, development of hydrographs using non-linear reservoir and kinematic techniques, groundwater, hydraulic conductivity, Darcy's law, intrinsic permeability, water potential, hydraulic head, unsaturated zone, aquifers, aquicludes, aquitards, steady state flow, transient flow, effective stress, transmissitivity, storativity, pump test interpretation.

## Course Aims

The objectives of this course are to:
Introduce you to the practice of water resources engineering.ï? To instruct you in the basic hydrological measurement techniques required
To teach you how to estimate rainfall occurrence
To teach you how to estimate the height and extent of possible flooding so that efficient engineering design can be carried out
To develop an awareness of the energy and water fluxes in the environment
To introduce you to groundwater and the techniques used to estimate quantity of available groundwater resource.

## Course Learning Outcomes

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. Undertake a basic assessment of groundwater resources | PE2.2, PE2.3, PE3.3 |

## Teaching Strategies

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

| | |
|---|---|
| **Lectures** | • Find out what you must learn<br>• Learn more details on the methods and theory that are not covered in the notes<br>• Follow worked examples<br>• Hear announcements on course changes |
| **Workshops** | • Be guided by demonstrators<br>• Practice solving set problems<br>• Ask questions |
| **eLearning** | • Lecture notes will be made available to you in Moodle. Worked workshop solutions to selected problems will also be made available. |
| **Email** | • You should check your email regularly (daily is the recommended frequency) to ensure that you are aware of any course announcements. |
| **Assessments (examinations, quiz, assignments)** | • Demonstrate your knowledge and skills<br>• Demonstrate higher understanding and problem solving |

## Additional Course Information

Water Resources Engineering will provide the basic information describing the hydrological cycle and those components of it that are essential to engineering design and process understanding. The main course taken before Water Resources Engineering (CVEN3501) which supports its content is:

• Principles of Water Engineering (CVEN2501)/Fluid Mechanics (ENGG2500): The object of CVEN2501/ENGG2500 is to introduce students to the practice of water engineering. Topics discussed include properties of fluids, manometry, hydrostatics, the principles of mass conservation, energy conservation, the forces and momentum in flowing fluids, flow in pipes, boundary layers, dimensional analysis, physical models, flow in open channels inclusive of specific energy, Manning and Chezy equations, uniform flow, subcritical and supercritical flow, hydraulic jumps, and gradually varied flow profiles.

Courses to be taken after Water Resources Engineering (CVEN3501) which are supported by its content are:

• Water and Wastewater Engineering (CVEN3502): the design and operation of (i) water treatment plants, (ii) wastewater treatment plants, (iii) stormwater systems, (iv) water distribution systems and (v) sewage distribution systems require knowledge of free surface computations, head losses due to friction in pipes, local head losses due to pipe fittings and shear stresses at flow boundaries which maintain pipes and channels which are scoured clean.

• Solid Wastes and Contaminant Transport (CVEN3702): quantifying the rate of pollutant transport and dispersion in pipes, streams, rivers and estuaries requires knowledge of flow regimes (laminar and turbulent) and the velocity profiles in boundary layers.

• Groundwater resource Investigation (CVEN4503): this course aims to develop the understanding of groundwater processes and provide students with techniques to investigate its occurrence and quality

# Assessment

| Assessment task | Weight | Due Date | Course Learning Outcomes Assessed |
|---|---|---|---|
| 1. Weekly Online Quiz | 15% | weekly 11pm same day as release | 1, 2, 3, 4 |
| 2. Assignment 1 | 25% | 01/04/2022 11:00 PM | 1, 2, 3 |
| 3. Assignment 2 | 15% | 22/04/2022 11:00 PM | 1, 4 |
| 4. Final Exam | 45% | See Exam timetable | 1, 2, 3, 4 |

## Assessment 1: Weekly Online Quiz

**Start date:** 18/02/2022 02:00 PM
**Submission notes:** Online submission via Moodle
**Due date:** weekly 11pm same day as release
**Marks returned:** Marks returned each week after submission

Online Quizzes (Moodle) to test your understanding of the lecture material for that week. Note - quiz is released at start of workshop and needs to be completed the same day.

### Assessment criteria

Full marks for correct answer else a 2nd attempt is prompted

### Additional details

| Item | Weight (%) | Learning outcomes assessed | Assessment Criteria | Issue date | Due date |
|---|---|---|---|---|---|
| Online Quizzes<br><br>(Moodle) | 15% | · The online quizzes will each collectively contribute to 15% of your mark for the subject (equal weight for each quiz)<br><br>· These quizzes will give you the opportunity to review your progress in the course as you go<br><br>· You will be given select questions for each online quiz | · The assessment will broadly be based on their understanding of the subject and answers to the questions asked<br><br>· Students will be assessed against their understanding of the theory of the subject and the associated assumptions in applying the theory | Weeks 1-9 | Each quiz will be released at the start of the tutorial session and remain open until 11pm of that day |

| | | | | | |
|---|---|---|---|---|---|
| | | taken from a database of questions<br><br>· You will be able to have 2 attempts at each quiz with your higher mark taken | | | |

## Assessment 2: Assignment 1

**Start date:** 18/02/2022 11:00 AM
**Submission notes:** See Moodle for submission details
**Due date:** 01/04/2022 11:00 PM

Assignment on design flood estimation

**Assessment criteria**

· Students are expected to provide brief and to the point answers to the questions asked.

· If some information is missing or not clear, it should be stated clearly in the assignment.

· The assessment will broadly be based on their understanding of the subject and answers to the questions asked.

· They are expected to justify the reason for going for a particular evaporation or flood estimation model.

**Additional details**

| Item | Weight (%) | Learning outcomes assessed | Assessment Criteria | Issue date | Due date |
|---|---|---|---|---|---|
| Ass#1:<br><br>· Water cycle<br><br>· Engineering hydrology | 25% | · Fundamental understanding on hydrology and various components of hydrologic cycle including evaporation<br><br>· 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 asked.<br><br>· If some information is missing or not clear, it should be stated clearly in the assignment.<br><br>· The assessment will broadly be based on their understanding of the subject and answers to the questions asked.<br><br>· They are expected to justify the reason for going for a particular evaporation or flood estimation model. | 18 Feb 2022 | 11:00PM,<br><br>01 April 2022<br><br>(to be submitted via Moodle) |

## Assessment 3: Assignment 2

**Start date:** 08/04/2022 11:00 AM
**Submission notes:** See Moodle for details
**Due date:** 22/04/2022 11:00 PM

Assignment on Groundwater Investigations

**Assessment criteria**

· 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 groundwater and the associated assumptions in applying the theory.

**Additional details**

| Item | Weight (%) | Learning outcomes assessed | Assessment Criteria | Issue date | Due date |
|---|---|---|---|---|---|
| Ass#2:<br><br>· Groundwater | 15% | · Assessing your knowledge on the fundamentals of groundwater and the techniques used to estimate groundwater resources | · Students are expected to provide brief and to the point answers to the questions asked.<br><br>· The assessment will broadly be based on their understanding of the subject and answers to the questions asked.<br><br>· Students will be assessed against their understanding of the groundwater and the associated assumptions in applying the theory. | 08 April 2022 | 11:00PM,<br><br>22 April 2022<br><br>(to be submitted via Moodle) |

## Assessment 4: Final Exam

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

Assesses student understanding of all material covered in the course.

**Assessment criteria**

· Students are expected to provide brief and to the point answers to the questions asked

· 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 their understanding of the subject and answers to the questions asked

**Hurdle requirement**

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

**Additional details**

| Item | Weight (%) | Learning outcomes assessed | Assessment Criteria | Issue date | Due date |
|---|---|---|---|---|---|
| Final Exam | 45% | · Final examination constitutes a core part of the course and will be closed book of 2 hours duration<br><br>· It will test your learning and knowledge gained during the semester<br><br>· Exam will be online in 2021 with instructions provided during the course | · Students are expected to provide brief and to the point answers to the questions asked<br><br>· A brief discussion on the distribution fitting and the selection of appropriate distribution is expected<br><br>· If some information is missing or not clear, it should be stated clearly in the assignment<br><br>· The assessment will broadly be based on their understanding of the subject and answers to the questions asked | Formal exam period | Immediately after exam |

## Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

## Course Schedule

| Week | Date | Lecturer | Topic | Assessments | Workshop |
|---|---|---|---|---|---|
| Week 1 | 15/02/2022<br><br>18/02/2022 | AS | Water and Energy Cycles, Climate change, meteorological variables and evaporation | Online quiz 1<br><br>Ass#1 issued | Workshop 1 |
| Week 2 | 22/02/2022<br><br>25/02/2022 | AS | Rainfall and streamflow measurements, Rainfall estimation, catchment delineation and water balance | Online quiz 2 | Workshop 2 |
| Week 3 | 01/03/2022<br><br>04/03/2022 | AS | Losses, rainfall-runoff modelling basics | Online quiz 3 | Workshop 3 |
| Week 4 | 08/03/2022<br><br>11/03/2022 | AS | Flood Frequency Analysis | Online quiz 4 | Workshop 4 |
| Week 5 | 15/03/2022<br><br>18/03/2022 | AS | IFD relationships, temporal patterns, design Floods | Online quiz 5 | Workshop 5 |
| **Week 6** | **22/03/2022**<br><br>**25/03/2022** | | ***No lectures or workshops*** | **-** | **-** |
| Week 7 | 29/03/2022 | AS | • Regional frequency analysis and rational method | Online quiz 6 | Workshop 6 |
| | 01/04/2022 | AS | • Unit Hydrograph for flood estimation | | |
| Week 8 | 05/04/2022 | MA | • Introduction to Groundwater Resources and Darcy's Law<br><br>• Groundwater in Australia | Online quiz 7<br>Ass#2 issued (08/04/2022) | Workshop 7 |
| | 08/04/2022 | MA | • Groundwater flow equations<br><br>• Introduction to assignment 2 | | |
| Week 9 | 12/04/2022 | MA | • Aquifer storage properties• | Online quiz 8 | |
| | 15/04/2022 | MA | ***No lecture/workshop (Easter Friday)*** | | |
| Week 10 | 19/04/2022<br><br>22/04/2022 | MA | • Borehole types & construction<br><br>• Pumping test analysis & groundwater in Australia | Online quiz 9 | Workshop 8 |
| Week 10 | 22/04/2022 | MA | • Groundwater surface water interactions | - | - |

# Resources

## Recommended Resources

There is no textbook for this course. Electronic copies of the notes are available from Moodle.

Recommended reading:

**Flood Hydrology**

- 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

**Groundwater**

- Fetter, C.W. (2001) Applied Hydrogeology. Prentice Hall, ISBN: 0131226878

## Laboratory Workshop Information

See Moodle for Workshop information

## 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 2022 will be held online between 29th April - 12th May inclusive, and supplementary exams between 23rd - 27th May inclusive. 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
- 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

## Image Credit

Mike Gal.

## CRICOS

CRICOS Provider Code: 00098G

## Acknowledgement of Country

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

# Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

| **Program Intended Learning Outcomes** | |
|---|---|
| Knowledge and skill base | |
| PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline | ✓ |
| PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline | ✓ |
| PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline | |
| PE1.4 Discernment of knowledge development and research directions within the engineering discipline | |
| PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline | ✓ |
| PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline | |
| Engineering application ability | |
| PE2.1 Application of established engineering methods to complex engineering 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 | |
| Professional and personal attributes | |
| PE3.1 Ethical conduct and professional accountability | |
| PE3.2 Effective oral and written communication in 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 | |