School of Civil and Environmental Engineering

Term 3, 2019

CVEN9612 Catchment and Water Resources Modelling (Short Course Mode)

COURSE DETAILS

Units of Credit	**6**
Contact hours	2 x 3-day short course • Week 2: Wed 25, Thurs 26, Fri 27 Sep • Week 3: Mon 30 Sep, Tues 1, Wed 2 Oct
Class	• AM Lecture: 9:00 - 12:30 • PM Lecture: 13:30 - 17:00 CE701
Workshop	• Thurs 26 Sep: 10:30 - 12:30 • Fri 27 Sep: 13:30 - 17:00 • Wed 2 Oct: 14:30 - 17:00 CE 611
Course Coordinator	Seokhyeon Kim (SK) email: seokhyeon.kim@unsw.edu.au office: Water Research Centre, Kensington phone: 9385 6156
Lecturer	Ashish Sharma (AS) email: a.sharma@unsw.edu.au office: School of Civil and Environmental Engineering, Kensington CE307 phone: 9385 5768 Raj Mehrotra (RM) email: r.mehrotra@unsw.edu.au office: Water Research Centre, Kensington phone: 9385 5140

INFORMATION ABOUT THE COURSE

An introduction to lumped and distributed catchment runoff models; an introduction on the rationale used for model verification and validation, model development and parameter estimation; Bayesian methods for estimating model parameters; reservoir and channel routing; reservoir operation and design; wetland design and conceptual processes; introduction to hydrologic time series characterization and stochastic modeling in the context of water resources management; Climate change: Bias correction and downscaling models.

HANDBOOK DESCRIPTION

See link to virtual handbook:

https://www.handbook.unsw.edu.au/undergraduate/courses/2019/CVEN9612/

OBJECTIVES

Objective of the course is to impart advanced knowledge in Water Engineering with a focus on Hydrology and Water Resources Engineering methodologies. The course consists of two halves, both being taught as short courses. The first part focuses on catchment surface models, and the second part focuses on water resources management.

TEACHING STRATEGIES

The teaching strategies that will be used include:

- **Lectures** that will focus on the development and application of the development of rainfall-runoff models, catchment hydrological characteristics and processes and approaches to time series analysis, optimization approaches and other statistical techniques for hydrological investigation.
- **Workshop** classes will concentrate on strategies for solving such problems. You will be encouraged, from time to time, to work alone as well as in small groups to solve problems.
- **Computer Laboratory** exercises will also be used to assess operational application of analytical techniques and other concepts developed throughout the course.

Suggested approaches to learning in this course include:

- Regular participation in lectures and Workshops. Review lecture and Workshop material. Follow worked examples.
- Reflect on class problems and quizzes.
- Regular reading and reviewing of your learning.
- Appropriate preparation for Workshop activities.
- Planning your time to achieve all assessment requirements (see assessment)
- We encourage you to work with your peers. A good way to learn the material is in small study groups. Such groups work best if members have attempted the problems individually before meeting as a group.

Successful completion of this course will require active involvement by the student in:

Private Study	• Review lecture material • Do set problems and assignments • Reflect on class problems and assignments • Do internet and library searches on topics related to the course • Participate in class discussions on review questions at end of lecture notes
Lectures	• Find out what you must learn • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by demonstrators • Practice solving set problems • Ask questions
Assessments (exam, assignments)	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving

EXPECTED LEARNING OUTCOMES

It is expected that the student will have a clearer understanding of Water Engineering, its relevance in engineering design, and its application in water resources management. The student will be familiar with the development and operation of rainfall-runoff models, be familiar with the range of observation and modeling tools available to the water resource manager, understand the limits of models and the importance of calibration/validation, and how to undertake data and modeling analysis using a range of statistical and other analytical approaches in a changed climate.

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

Learning Outcome		EA Stage 1 Competencies
1.	*Perform rainfall runoff modelling using conceptual models*	*PE1.1, PE1.5, PE2.2, PE2.3*
2.	*Perform semi-distributed hydrologic modelling.*	*PE1.2, PE2.2, PE2.3*
3.	*Understand differences between conceptual and distributed models*	*PE1.2, PE2.2, PE2.3*
4.	*Understand the basis for model calibration and validation*	*PE1.1, PE2.2, PE2.3, PE3.3*
5.	*Assess reservoir sizing and operation*	*PE1.1, PE2.2, PE2.3, PE3.3*
6.	*Perform simple time series analysis and use this to quantify uncertainty*	*PE1.2, PE2.2, PE2.3*
7.	*Assess implications of climate change on reservoir operation and learn how to correct systematic biases in climate model simulations*	*PE2.2, PE2.3, PE3.3*

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

COURSE PROGRAM

The course schedule tabulated below shows the main topics and approximately how long will be spent on each topic in lectures. Please note that the lecture durations and sequence of topics is a guide only; there may be some variations. However, details on the associated assessment tasks should not be affected; if they are you will be informed.

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Day	Time	Topic	Lecture Room
Day 1 **25th Sep (Wed)**	09:00 – 09:30	Introduction to the course (AS)	CE701
	09:30 – 12:30	Watershed concepts and characteristics (AS) • Catchment processes: rainfall, evaporation, infiltration and runoff • Understanding the hydrograph • Flood routing approaches	CE701
	13:30 – 16:00	Rainfall-runoff modelling: (AS) • The role of modelling • Objectives and concepts • Types of models • Model components and conceptualizations	CE701
	16:00 - 17:00	Class workshop: process representation and flood routing (AS)	CE701
Day 2 **26th Sep (Thu)**	09:00 – 10:30	Review of model calibration, validation, sensitivity and uncertainty analyses (AS)	CE701
	10:30 – 12:30	**Computer lab workshop**: AWBM + RORB (SK)	CE611
	13:30 – 17:00	Semi-distributed modelling (SMART) (AS, SK)	CE701
Day 3 **27th Sep**	09:00 – 12:30	Application of SMART, data requirements, realities and limitations (AS, SK)	CE701

(Fri)	13:30 – 17:00	**Computer lab workshop**: SMART (SK)	CE611
Day 4 30th Sep (Mon)	09:00 – 11:00	Introduction, reservoir design and operation (AS)	CE701
	11:00 – 12:30	Reservoir simulation methods, definition of storage capacity (AS)	CE701
	13:30 – 15:00	Storage capacity continued (AS)	CE701
	15:00 – 17:00	Class workshop: reservoir design and storage (AS)	CE701
Day 5 1st Oct (Tue)	09:00 – 11:00	Introduction to simple time series models (AS)	CE701
	11:00 – 12:30	Advanced time series simulation methods, seasonal models, downscaling models (AS)	CE701
	13:30 – 15:00	Downscaling models continued (AS)	CE701
	15:00 – 17:00	Class workshop: time series models (AS)	CE701
Day 6 2nd Oct (Wed)	09:00 – 12:30	Climate change and bias correction (AS)	CE701
	13:30 – 14:30	Lecture for computer lab workshop: climate change, bias correction, downscaling (RM)	CE701
	14:30 – 17:00	**Computer lab workshop**: climate change, bias correction, downscaling (SK, RM)	CE611

ASSESSMENT

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. If you apply for and receive special consideration for any of the assignments, a scaling of your final exam marks will be carried out. It is recommended that students who perform poorly in the assignments and workshops discuss progress with the lecturer during the semester. The formal exam scripts will not be returned. The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

ASSESSMENT OVERVIEW

The course learning outcomes include a significant level of technical learning, calculations, and engineering understanding of problems. These outcomes can be effectively and ideally assessed in an exam environment that can reflect the students' understanding of concepts, and the students' abilities to make decisions and solve problems within limited time. The final exam will be held under open book conditions. You need to score at least 40% in the final exam to be able to pass the course.

The assessment is separate for the two halves of the course, but there is related course material.

- Catchment Modelling (Days 1-3): assignment: 25%, exam: 25%
- Water Resources Modelling (Days 4-6): assignment: 30%, exam: 20%

- Assignments (55%)
  - ❖ #1: Rainfall-Runoff Modelling and Computation (25%, due on: 8 Oct, marks return: 12 Oct)
  - ❖ #2: Reservoir Modelling Application (30%, due on: 1 Nov, marks return: 15 Nov)

- Final Exam (45%)
  - ❖ 2-hour duration during the examination period (29 Nov – 14 Dec)
  - ❖ one A4 page of handwritten or printed notes on both sides (to be collected with exam paper and booklet)

PENALTIES

Late submissions of the assignments will result in penalties dependent on the number of days of delay.

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: 17th March; Term 3: 30th June, Term 3: 13th October) more information found here

RELEVANT RESOURCES

There is no subject textbook but a number of recommended reference books for this course are as follows:

- Handbook of Hydrology (1992), by D.R. Maidment (Editor in Chief); published by McGraw-Hill, Inc.
- Water Resources Engineering (2001), by L. W. Mays; published by John Wiley & Sons Inc.
- Applied Hydrology (1988), by Chow, Maidment and Mays; published by McGraw-Hill Inc.
- Hydrology, An Australian Introduction (2008), by Anthony Ladson; Oxford University Press.

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