USC

Course Outline

Code: ENG330
Title: Engineering Hydrology

School of: Science & Engineering
Teaching Session: Semester 2
Year: 2019
Course Coordinator: Dr Helen Fairweather Email: hfairwea@usc.edu.au
Course Moderator: Dr Adrian McCallum

Please go to the USC website for up to date information on the teaching sessions and campuses where this course is usually offered

1. What is this course about?

1.1 Description

This course equips you with a background in hydrological techniques used by professional engineers, including those codified in Australian Rainfall and Runoff-A Guide to Flood Estimation. You will gain basic skills to carry out the hydrologic analyses and designs that are often encountered in engineering practice. Knowledge of engineering hydrology is required for the design of storm water drainage systems and for the management of flooding. The course will show how design estimates are made by calculation and by modelling.

1.2 Course topics

· Hydrological processes and data measurement
  - The hydrologic cycle
  - Rainfall, evaporation and infiltration measurement
  - Streamflow measurement
· Floods and Flood Frequency analysis
  - Runoff generation
  - Statistical tools for hydrological analysis
  - Flood Frequency curves
· Design rainfalls
  - IFD curves
  - Temporal rainfall patterns
  - Design storm
· Estimating peak discharge
  - Rational method
· Design flow hydrographs
  - Hydrograph components
· Using Flood hydrographs
  - Catchment routing
  - Reservoir routing
· Rainfall runoff monitoring
  - Loss models
  - Rainfall-runoff models
  - Modelling applications

2. What level is this course?

300 level Graduate - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 3rd or 4th year of an undergraduate program

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
Reflect on the importance of hydrological design in major engineering projects and build confidence and a competency in design abilities	Task 1, 2	Knowledgeable. Empowered.
Explain key hydrological processes that are important from an engineering perspective	Task 1, 2, 3	Knowledgeable.
Explain how rainfall, streamflow and evapotranspiration data are measured and presented	Task 3	Knowledgeable.
Explain how floods are statistically defined and estimate design flood magnitude based on a frequency analysis of historical data	Task 1, 3	Knowledgeable.
Derive and apply design rainfalls for engineering purposes using the Australian Rainfall and Runoff methods	Task 2, 3	Knowledgeable. Empowered.
Apply loss models that are used to determine runoff from rainfall	Task 2, 3	Knowledgeable.
Produce discharge hydrographs from catchments and the routing of flood hydrographs along stream channels and within reservoirs	Task 2, 3	Knowledgeable. Creative and critical thinkers.
Calculate peak flow discharges required for engineering design purposes using the rational method	Task 3	Knowledgeable. Creative and critical thinkers.
Demonstrate how hydrological computer models are calibrated, validated and applied in design.	Task 3	Creative and critical thinkers. Empowered.

5. Am I eligible to enrol in this course?

Refer to the USC Glossary of terms for definitions of "pre-requisites, co-requisites and anti-requisites".

5.1 Enrolment restrictions

Nil

5.2 Pre-requisites

SCI110 and (MTH202 or MTH102 or MTH103)

5.3 Co-requisites
Nil

5.4 Anti-requisites
Nil

5.5 Specific assumed prior knowledge and skills (where applicable)
Nil

6. How am I going to be assessed?

6.1 Grading scale
Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

6.2 Details of early feedback on progress
On online quiz will be held in weeks 3 and 5, to ascertain whether the student has grasped the fundamental concepts being taught.

6.3 Assessment tasks

Task No.	Assessment Tasks	Individual or Group	Weighting %	What is the duration / length?	When should I submit?	Where should I submit it?
1	Design Flood Assignment	Individual	35%	Web report written in R Markdown equivalent to 5 x A4 pages including graphs, tables and explanation	Week 7	Blackboard Safe Assign
2	Design Storm Assignment	Individual	35%	Web report written in R Markdown equivalent to 5 x A4 pages including graphs, tables and explanation	Week 13	Blackboard Safe Assign
3	Online Quizzes	Individual	30%	3 x online quizzes	Weeks 3, 5 and 10	Blackboard
			100%			

Assessment Task 1: Design Flood assignment 35%

Goal:	Apply the design methodologies discussed in lectures and tutorials to produce a Design Flood to a scenario related to the course material.
Product:	A spreadsheet or web-based tool showing all the steps in your working and solution for the design
Format:	The standard will be that of a professional engineering report with appropriate headings, graphs, tables and explanations. The maximum length is equivalent to 5 x A4 pages.
Criteria:	Identification of the importance of the hydrological design method for major engineering projects. Explanation of how the key hydrological processes that impact the flood design task. Correct application of the key hydrological design tools (Flow Duration Curve and frequency analysis of the Annual Maximum Series) Validity and uncertainty of flood frequency analysis method, including a sensitivity analyses. Description of statistical procedures and discussion on inputs and outputs (streamflow records, extraction of peak flows, frequency analyses and application of empirical distribution) Quality of report and clarity of presentation that demonstrates confident and competent application of the hydrological design method.
Engineers Australia Competencies	
2.3 Application of systematic engineering synthesis and design processes within the technology domain	

Assessment Task 2: Design Storm assignment 35%

Goal:	Apply the appropriate techniques to produce a Design Storm and hydrograph required as input to a hydrological model.
Product:	A report that implements the method to solve this problem and a report showing all the steps in your working and solution for the design.
Format:	1a) Draft working prototype in Excel or R 1b) Report The standard will be that of a professional engineering report with appropriate headings, graphs, tables and explanations. The maximum length is equivalent to 5 x A4 pages. The prototype should be scalable (e.g. reusable for any other location). The calculations should be such that when the user selects different inputs, the outputs are automatically updated.
Criteria:	Development of a tool to extract design rainfalls (Intensity, Frequency and Duration) for a range of locations from the Australian Rainfall and Runoff data repository. Clear representation of design rainfall for use in engineering design. Appropriate application of loss models, temporal patterns and areal reduction factors to produce a hydrograph. Calculation and interpretation of the probability characteristics of a real rainfall event for a range of durations, compared to the design rainfall to explain the importance of the key hydrological processes in engineering design. Quality of report and clarity of presentation that demonstrates confident and competent application of the hydrological design method
Engineers Australia Competencies	
2.2 Fluent application of engineering techniques, tools and resources.	

Assessment Task 3: Online Quizzes 30%: 3 x 10%

Goal:	The goal of these quizzes is to demonstrate your understanding of various issues relating to the topics presented and answer questions that require analysis of data and interpretation of information.
Product:	You will be required to complete three 45 minute quizzes based on information covered in the lectures and in directed readings.
Format:	The quizzes will be computer based and will be a mixture of multiple choice, short answer questions and finding a solution to fully worked problems
Criteria:	Students will be assessed on the ability to: Explain the key hydrological processes that are important from an engineering perspective. Explain how rainfall, streamflow and evapotranspiration data are measured and presented. Estimate design flood magnitudes using a flood frequency analysis· Apply a loss model to extract runoff from rainfall Routing of a flood hydrograph along a stream channel or within a reservoir Apply the rational method to calculate peak discharge Competent and confident calibration, validation and application of hydrological computer models
Engineers Australia Competencies	
2.1 Application of established engineering methods to complex engineering problems solving.	

7. What are the course activities?

7.1 Directed study hours

The directed study hours listed here are a portion of the workload for this course. A 12 unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Directed study hours may vary by location. Student workload is calculated at 12.5 learning hours per one unit.

Location: Specific Campus(es) or online:	**Directed study hours for location:**
USC Sunshine Coast	One 2-hour lectures weeks 1-13 One 2-hour tutorial weeks 2-13

7.2 Course content

Week # / Module #	**What key concepts/content will I learn?**
1	Nature of this course: aims, objectives and assessment. The hydrologic cycle Rainfall, evaporation and infiltration measurement
2	Surface runoff generation processes. Measuring streamflow
3	Data verification Statistical measures and distributions in hydrology
4	Flood Frequency analysis
5	Flood peaks, hydrographs and the Rational Method
6	Rainfall characterisation The IFD curve
7	Producing a Design Storm
8	Flood Routing concepts The Muskingum Method
9	Catchment and Reservoir modelling The RORB model
10	Model calibration, validation processes
11	Rainfall – Runoff Models
12	Practical Hydrological Modelling
13	Summary lecture

*Please note course content is subject to variation.

8. What resources do I need to undertake this course?

Please note that course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Blackboard site. Please log in as soon as possible.

8.1 Prescribed text(s)

Please note that you need to have regular access to the resource(s) listed below as they are required:

Author	**Year**	**Title**	**Publisher**
Ladson, A	2008	Hydrology- An Australian Introduction	Oxford University Press
Bates, D. et al.	2014	The R Project for Statistical Computing program	http://www.r-project.org/
RStudio	2014	RStudio + R Markdown	http://www.rstudio.com/ and http://www.rstudio.com/ide/docs/r_markdown
Ball, J. et al. (editors)	2016	Australian Rainfall and Runoff: A Guide to Flood Estimation	http://arr.ga.gov.au/

8.2 Specific requirements

N/A

9. Risk management

Health and safety risks for this course have been assessed as low.

It is your responsibility as a student to review course material, search online, discuss with lecturers and peers, and understand the health and safety risks associated with your specific course of study. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module for students, and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1 Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

10.2 Assessment: Additional requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

a) The final mark is in the percentage range 47% to 49.4%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate:

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task.
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task.
- A result of zero is awarded for an assessment task submitted after seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.
To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub. Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website:
http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching

10.6 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **USC South Bank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **USC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **USC Fraser Coast -** Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **USC Caboolture -** Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890
Email: studentcentral@usc.edu.au