

# ES3D5-15 Water Engineering for Civil Engineers

**23/24**

**Department**

School of Engineering

**Level**

Undergraduate Level 3

**Module leader**

Soroush Abolfathi

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

30% coursework, 70% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES3D5-15 Water Engineering for Civil Engineers

[Module web page](#)

### Module aims

Knowledge of water engineering is essential for good practice of civil and environmental engineering. This module provides background material on open channel hydraulics and engineering hydrology that serve as a sound base for other relevant civil and environmental modules and for future professional practice. The module will enable students to understand the principles of free surface flows and engineering hydrology applied to civil engineering problems.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Open Channel Hydraulics

- Review of hydrostatics, pipe flow and Bernoulli equation
- Laminar and turbulent flow in open channels
- Laminar flow analysis
- Principles of uniform flow
- Development of friction equations - magnitude of friction coefficients
- Channels with distorted cross-sections & “Best form” cross-sections
- Development of energy concepts & specific energy
- Critical flow considerations
- Applications of the energy principle
- Measurement structures and dilution gauging
- Development of conservation of momentum principle
- Specific force considerations
- Analysis of hydraulic jump
- Gradually varied flow equation & classification of gradually varied flow profiles
- Methods for the calculation of gradually varied flow profiles
- Location of hydraulic jump
- Introduction to commercial numerical software

### Engineering Hydrology

- The hydrological cycle
- Precipitation, initial losses, infiltration, percolation, evapotranspiration, surface runoff, groundwater flow
- Rainfall types and spatial variability of rainfall (UK)
- Rainfall. Intensity - duration - frequency (return period) analysis
- The Flood Estimation Handbook (FEH)
- Design storm rainfall. Uniform intensity and FEH rainfall profiles
- River flow analysis
- The unit hydrograph
- FEH techniques to estimate runoff from catchment characteristics; impacts of urbanisation
- Reservoir routing

### Learning outcomes

By the end of the module, students should be able to:

- explain the principles controlling open channel flows
- summarise the differences between flow types
- analyse free surface flow problems using friction, energy and momentum considerations
- predict rainfall and runoff characteristics for UK catchments

### Indicative reading list

- (1) Chadwick, A.J. & Morfett, J.C. Borthwick M. Hydraulics in Civil and Environmental Engineering (5th Edition) Spon 2013
- (2) Chanson, H. The Hydraulics of Open Channel Flow Arnold (2nd Edition) 2004
- (3) Douglas, J.F., Gasiorek, J.M., Swaffield, J.A. & Jack L., Fluid Mechanics (6th Edition) Wiley

### **Subject specific skills**

1. Ability to conceive, make and realise a component, product, system or process
2. Ability to develop economically viable and ethically sound sustainable solutions
3. Ability to be pragmatic, taking a systematic approach and the logical and practical steps necessary for, often complex, concepts to become reality
4. Ability to seek to achieve sustainable solutions to problems and have strategies for being creative and innovative
5. Ability to be risk, cost and value-conscious, and aware of their ethical, social, cultural, environmental, health and safety, and wider professional engineering responsibilities

### **Transferable skills**

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
  2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
  3. Communicate (written and oral; to technical and non-technical audiences) and work with others
  4. Exercise initiative and personal responsibility, including time management, which may be as a team member or leader
  5. Awareness of the nature of business and enterprise in the creation of economic and social value
  6. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner
  7. Ability to formulate and operate within appropriate codes of conduct, when faced with an ethical issue
  8. Appreciation of the global dimensions of engineering, commerce and communication
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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	30 sessions of 1 hour (20%)
Tutorials	13 sessions of 1 hour (9%)
Demonstrations	1 session of 2 hours (1%)
Private study	105 hours (70%)
Total	150 hours

### **Private study description**

105 hrs of guided independent learning

## Costs

No further costs have been identified for this module.

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## Assessment

You must pass all assessment components to pass the module.

Students can register for this module without taking any assessment.

### Assessment group D6

	Weighting	Study time
Hydrology in class test	30%	
Hydrology in class test, closed book		
Online Examination	70%	
QMP		
~Platforms - AEP,QMP		

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- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

### Feedback on assessment

Oral feedback (as group and one-to-one if requested) in dedicated session

Cohort level feedback for both test and QMP

[Past exam papers for ES3D5](#)

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## Availability

### Courses

This module is Core for:

- Year 3 of UESA-H216 BEng Civil Engineering
- Year 4 of UESA-H215 BEng Civil Engineering with Intercalated Year

- Year 3 of UESA-H217 MEng Civil Engineering
- Year 4 of UESA-H218 MEng Civil Engineering with Intercalated Year

This module is Core optional for:

- Year 3 of UESA-H218 MEng Civil Engineering with Intercalated Year
- Year 3 of UESA-H115 MEng Engineering with Intercalated Year
- Year 3 of UESA-H11L Undergraduate Engineering (with Intercalated Year)

This module is Optional for:

- Year 3 of UESA-H113 BEng Engineering
- Year 3 of UESA-H114 MEng Engineering
- Year 4 of UESA-H115 MEng Engineering with Intercalated Year
- UESA-H11L Undergraduate Engineering (with Intercalated Year)
  - Year 3 of H11L Engineering (with Intercalated Year)
  - Year 4 of H11L Engineering (with Intercalated Year)

This module is Option list A for:

- Year 4 of UESA-H111 BEng Engineering with Intercalated Year
- UESA-H112 BSc Engineering
  - Year 3 of H112 Engineering
  - Year 3 of H112 Engineering