

# ES3G7-15 Water Engineering

**20/21**

**Department**

School of Engineering

**Level**

Undergraduate Level 3

**Module leader**

Jonathan Pearson

**Credit value**

15

**Module duration**

24 weeks

**Assessment**

50% coursework, 50% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES3G7-15 - Water Engineering

[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:

- Critique the central role of water in our society.
- Demonstrate critical knowledge and understanding of disciplinary theories, positions and research themes related to the field of water.
- Explain in detail the principles controlling open channel flows.
- Critically summarise the differences between flow types.
- Analyse free surface flow problems using friction, energy and momentum considerations.
- Predict and interpret 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 2011

(4) Shaw E.M., Beven K.J., Chappell N.A. & Lamb R., Hydrology in Practice, Spon 2010

## **Subject specific skills**

No subject specific skills defined for this module.

## **Transferable skills**

No transferable skills defined for this module.

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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	20 sessions of 1 hour (13%)
Tutorials	6 sessions of 1 hour (4%)
Practical classes	3 sessions of 1 hour (2%)
Other activity	10 hours (7%)
Private study	111 hours (74%)
Total	150 hours

### **Private study description**

111 hours of guided independent learning (including VLE use and support from Employer)

### **Other activity description**

10 hours of webinars

## **Costs**

No further costs have been identified for this module.

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## **Assessment**

You do not need to pass all assessment components to pass the module.

## Assessment group C

	Weighting	Study time
Design exercise	50%	
Design exercise of 5 pages including calculations		
Online Examination	50%	
~Platforms - AEP,QMP		

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- Online examination: No Answerbook required
- Students may use a calculator
- Engineering Data Book 5th Edition
- Engineering Data Book 6th Edition
- Engineering Data Book 8th Edition
- Graph paper

## Feedback on assessment

Advice and feedback are available on the lecture material and examination questions, via online web-forum based in module support Moodle pages.

[Past exam papers for ES3G7](#)

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## Availability

### Pre-requisites

1 (Core)

## Courses

This module is Core for:

- Year 4 of DESA-H221 Undergraduate Civil and Infrastructure Engineering (Non-integrated Degree Apprenticeship)