LEARNING OUTCOMES

On successful completion of this module students will be able to:

1. Demonstrate a comprehensive knowledge of the engineering principles, analytical techniques and design approaches used in the design of hydraulic structures.
2. Demonstrate an ability to synthesise a range of ideas and concepts which describe the behaviour of water. Apply these to the design and analysis of complex hydrological and hydraulic structures/systems with minimum guidance.
3. Work independently, or in a small group, using relevant data sources and computational technologies.
4. Critically appraise the design of hydraulic structures, leading to the recommendation of preferred design solutions.

SYLLABUS

Overview
This module will be based around three independent hydrology/hydraulics design projects. The three projects may vary from year to year, with examples of typical projects being given below:

Reservoir Spillway Design
This is a large, two-part project, divided into two separately-assessed design exercises.
Part 1 - Hydrological analysis - Design rainfall, FSR and FEH, Synthetic unit hydrograph, Reservoir routing, Weir design.
Part 2 - Spillway design, gradually-varied flow and spatially-varied flow calculations, energy dissipation structures.

Culvert Design
Estimation of design flow, use of design monographs.

Design of a Flow Measurement Structure to BS3680
Use of a British Standard, Considerations of river and reach characteristics, including mobile bed, hydraulic physical scale modelling.

Rehabilitation of a Water Distribution System
Use of software for development, evaluation and selection of preferred design solution.

Sustainable Drainage System (SuDS) Design
This project will involve the use of simple laboratory scale model tests, in addition to a commercial SuDS modelling package, to generate and evaluate SuDS design options.

LEARNING HOURS

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<th>Activity</th>
<th>Hours</th>
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<tr>
<td>Lectures</td>
<td>18</td>
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<tr>
<td>Design Classes</td>
<td>30</td>
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<tr>
<td>Private Study including non invigilated assessment</td>
<td>49</td>
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<tr>
<td>Practical Classes</td>
<td>3</td>
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<td><strong>Total</strong></td>
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ASSIGNMENTS
1. The assessment for this module comprises three individual or small group design project reports. Each of the designs will primarily utilise material taught in earlier water engineering modules. As indicated in the syllabus section above, the specific focus of the three reports may vary from year to year. However each design exercise will test the student’s ability to select and apply appropriate hydrological analysis and hydraulic design techniques (including the use of spreadsheets, design charts and commercial software) in the context of hydraulic engineering design tasks. In order to complete the design tasks the learner will develop skills for selecting and managing technical information, and in the identification of appropriate knowledge, tools and methods to solve complex hydraulic engineering problems. The design reports themselves will assess communication skills, whilst the management of the work within tight timescales will develop their organisation and time management (autonomy) skills. The design reports are expected to include reference to health and safety, to justify design choices and to critically appraise designs with reference to sensitivity analysis and assumptions made.

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<th>ASSESSMENT</th>
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<td><strong>Item</strong></td>
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**Formative Assessment:**
Each of the three design projects will be marked rapidly, and individual marks and feedback given. A ‘model solution’ and class feedback will also be given for each topic.

**Reason for assessment choice:**
To pass at threshold a student will be required to show good knowledge and understanding of relevant hydraulic design methods and analysis procedures, and be able to undertake appropriate design and analysis work.

An excellent mark will require students to demonstrate that they have fully synthesised relevant concepts and can apply them effectively. This will be demonstrated through critical appraisal of their solution, including discussion of alternative approaches, sensitivity analysis, health and safety considerations, commentary on sources of uncertainty and any assumptions made. The most successful students will benefit from effective group-based problem-solving in the early stages, combined with efficient use of tutor support. Effective written communication skills will be assessed via the individual design reports, which should present the design solution, together with relevant sketches and a full justification for the design choices made. The tight time-scale and progressive nature of the design work will demand that students can take responsibility for their own work and keep progress under review (autonomy).

The method of assessment (i.e. individual design project reports) is considered to be more reflective of realistic design office constraints than an examination, and provides students with an opportunity to address the issues highlighted above.

**HEALTH AND SAFETY MATTERS ADDRESSED**
Design simple engineering systems for safety.

**RECOMMENDED READING (A-Class Book, B-Highly Recommended, C-Recommended)**


