Module Specification

Hydraulics and its Applications

Version: 2025-26, v1.0, 28 Jul 2023

Contents

Part 1: Information

Module title: Hydraulics and its Applications

Module code: UBGJCA-30-2

Level: Level 5

For implementation from: 2025-26

UWE credit rating: 30

ECTS credit rating: 15

College: College of Arts, Technology and Environment

School: CATE School of Architecture and Environment

Partner institutions: None

Field:

Module type: Module

Pre-requisites: Engineering Principles for Civil Engineering 2024-25

Excluded combinations: None

Co-requisites: None

Continuing professional development: Yes

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Hydraulics is the branch of fluid mechanics that deals with Water and the Environmental focus adopted by this module provides core material for Civil and Environmental Engineering. The skills developed will help an engineer understand natural flow phenomena and to design structures and systems that deal with fluid flow. The theory will be developed in Semester 1 before its application to the design of a pipe network in Semester 2.

Features: Not applicable

Educational aims: The module complements the studies of a civil engineering student by expanding the knowledge into the important field of hydraulic engineering, that supports other core areas of design in civil engineering. The students are building technical skills while advancing their critical thinking and cognitive skills to new dimensions through undertaking conceptual and feasibility studies that include the interactions of water with the built environment.

Outline syllabus: HYDRAULICS (FLUID MECHANICS):

-Statics: general properties of fluids, pressure, buoyancy.

-Basic Concepts of Fluid Motion: flow of Newtonian fluids, types of flow, drag.

-Two Dimensional Inviscid Flow: conservation equations, continuity, Bernoulli equation, kinematics of fluid motion, velocity, acceleration, streamlines.

-Dynamics: laminar and turbulent flows, Reynold's number, fluid acceleration, energy equation, momentum equation, flow around a cylinder, flow around aerofoils and over buildings.

-Open Channel Flow: design rainfall, classification, Manning’s equation, sections, normal depth, Bernoulli equation, critical depth, critical conditions, hydraulic jumps, flumes, weirs.

-Steady Flow in Pipes: Darcy equation, Moody diagram, HR Wallingford tables.

-Unsteady Pipe Flow: pressure surge – simulation and mitigation techniques.

-Machines: the use and characteristics of roto-dynamic pumps and turbines.

APPLICATIONS (FEASIBILITY STUDY):

Determine alternative design options.
Use Net Present Value analysis.

Part 3: Teaching and learning methods

Teaching and learning methods: Scheduled learning includes lectures and tutorials, practical work in the context of undertaking laboratory work, formative feedback sessions for students' assessments preparation and submission, external site visits and guest lectures from industry.

Independent learning includes hours engaged with essential reading, assignment preparation and completion etc. Students will receive on average 4 hours contact time per week.

The amount of time spent on activities in this module is shown below in hours:

Contact time: 72
Assimilation and development of knowledge: 150
Assessments preparation: 78
Total study time: 300

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate a detailed knowledge and understanding of the application of hydraulics to describe and solve problems encountered in civil engineering.

MO2 Assess and apply the requirements involved in the civil engineering design of a range of hydraulic structures.

MO3 Generate feasibility studies by selecting appropriate systems ,technologies and materials for a large-scale hydraulic application and by employing elementary technical-economical optimization.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 228 hours

Face-to-face learning = 72 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/lists/BB20720B-A96B-E75E-5BD8-58B985124A9C.html

Part 4: Assessment

Assessment strategy: The module will be assessed by a combination of an individual portfolio and an individual coursework report.

Individual Portfolio. Learning outcomes 1 and 2.

The portfolio will be a combination of calculation exercises, laboratory exercises and self reflection of students' work with main content of conceptualizing a hydraulic system and undertaking essential design of hydraulic components and including:

- decision making on appropriate design rainfall that will be used to size a reservoir
-calculate hydrostatic forces on dam structures upstream and downstream of a reservoir
- calculate pressures, forces, velocities, energy and flow rates through pipes and pipe bends, transferring water downstream of a reservoir
- identify types of flows in open channels and flow rates through flow control structures (culverts and weirs), downstream of a reservoir

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.

Coursework report. Learning outcomes 2 and 3.

Report to be based on a feasibility study of a hydraulic application
by deploying elementary technical-economical optimization at preliminary design

phase and recognizing essential elements for carrying out associated studies (technical report, general layout, pipe profiles).

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.

Assessment tasks:

Portfolio (First Sit)
Description: Conceptualize a hydraulic system and undertake essential design of hydraulic components including:
- decision making on appropriate design rainfall that will be used to size a reservoir
-calculate hydrostatic forces on dam structures upstream and downstream of a reservoir
- calculate pressures, forces, velocities, energy and flow rates through pipes and pipe bends, transferring water downstream of a reservoir
- identify types of flows in open channels and flow rates through flow control structures (culverts and weirs), downstream of a reservoir

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2

Report (First Sit)
Description: Report (3000 words) based on a feasibility study of a hydraulic application by deploying elementary technical-economical optimization at preliminary design phase and recognizing essential elements for carrying out associated studies (technical report, general layout, pipe profiles).

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.

Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO3

Portfolio (Resit)
Description: Conceptualize a hydraulic system and undertake essential design of hydraulic components including:
- decision making on appropriate design rainfall that will be used to size a reservoir
-calculate hydrostatic forces on dam structures upstream and downstream of a reservoir
- calculate pressures, forces, velocities, energy and flow rates through pipes and pipe bends, transferring water downstream of a reservoir
- identify types of flows in open channels and flow rates through flow control structures (culverts and weirs), downstream of a reservoir

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2

Report (Resit)
Description: Report (3000 words) based on a feasibility study of a hydraulic application by deploying elementary technical-economical optimization at preliminary design phase and recognizing essential elements for carrying out associated studies (technical report, general layout, pipe profiles).

Assessment will be based on relevance, depth of interpretation and standards of literacy and presentation.
Weighting: 50 %
Final assessment: Yes
Group work: No

Learning outcomes tested: MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Civil Engineering [Frenchay] BEng (Hons) 2024-25

Civil Engineering [Frenchay] MEng 2024-25