Module Title: Hydroelectric and Marine Energy Generation **2021**	**Module Code:** **EV7119** **Level: 7** **Credit: 15** **ECTS credit: 7.5**	**Module Leader**: Alan Owen **Additional tutors:** Frances Hill
Pre-requisite: none	**Pre-cursor:** none	
Co-requisite: none	**Excluded combinations :** none	

Location of delivery: CAT/By distance learning

The main aims of the module are to enable students to:

- Demonstrate a numerically informed understanding of the technological, and environmental benefits and limitations of energy generation from hydro and marine sources
- Derive a critical evaluation of the installation requirements, resource potential, maintenance needs, associated carbon emissions and environmental impacts of energy generation from hydro and marine sources
- Synthesize the above and apply to problem solving in a holistic and objective manner.

Main topics of study

- Technological aspects of hydro and marine energy generation
- Hydropower resource assessment using complex and simple methods
- Environmental and social impacts of hydro and marine energy generation
- Grid balancing, voltage and frequency control
- Pumped hydro energy storage

Learning Outcomes for the module

At the end of this module, students will be able to:

Knowledge

1. Demonstrate a critical understanding of the physics of energy generation from hydro and marine resources
2. Analyse system energy losses and evaluate turbine selection criteria

Thinking skills

3. Critically appraise the technological capabilities and limitations of the technologies;
4. Evaluate the environmental, social and CO2 emission life-cycle implications of hydro power

Subject-based practical skills

5 Synthesis of numerical data and terrain characteristics to evaluate hydro power resource and storage availability

Skills for life and work

6. Communicate effectively (written and oral) to a team, peer or a wider audience.

Teaching/ learning methods/strategies used to enable the achievement of learning outcomes:

The factual content of the module is taught through lectures, seminars, practical workshops, presentations, demonstrations and tutorials, and throughout this process an active exchange of views and opinions is encouraged. Both theoretical and practical aspects are covered. Students have access to Moodle discussion boards and to regular Skype surgeries where they can meet with their peers and a tutor to discuss any academic issue. The summative coursework consists of an academic investigative essay and presentation of this.

There is formative learning element to the module to allow the students to receive critical feedback on their work without the pressure of marked assessment.

For distance learning (DL) students, learning will be supported through Internet-based lectures (of the onsite lectures), situation related practical exercises, seminars and tutorials.

All students also have access to Moodle discussion boards and regular Skype surgeries, where they can meet with their peers and a tutor to discuss any academic issue.

Lectures onsite and through DL highlight key concepts, models and frameworks, and integrate additional resources (such as journal articles). They encourage deep learning through the use of self-assessment questions which encourage students to engage with the topic, to help students understand new topics and skills.

Assessment methods which enable students to demonstrate the learning outcomes for the module:	**Weighting:**	**Learning Outcomes demonstrated:**
1. Report (2,400 words)	80%	**1,2,3,4,5,6**
2. Presentation (600 words)	20%	**6**

Reading and resources for the module:

Core

- Harvey, A. (2002) *Micro-Hydro design manual*. ITDG Publishing, London. ISBN: 185331034 *
- Twidell, J. and Weir, T. (2015) *Renewable Energy Resources.* 3rd edition. Taylor and Francis, Oxford. (and erratum-download)

Recommended

- Lynn, P.A. (2013) *Electricity from Wave and Tide: An Introduction to Marine Energy*. Wiley. ISBN: 978-1-118-34091-2
- Samadi-Boroujeni, H (Ed.) (2012) *Hydropower - Practice and Application.* Intech. ISBN 978-953-51-0164-2, 332 pages, Publisher: InTech, DOI: 10.5772/1798 *
- Liengme, D.,(2007 or 2013) *A guide to Microsoft Excel for Scientists and Engineers*, Butterworth Heinemann, Oxford

Further relevant journals, websites and other relevant resources will be provided within reading materials that are made available for the module.

(*) Available as an e-book

Indicative learning and teaching time **(10 hrs per credit):**	**Activity**
1. Student/tutor interaction:	Lectures, seminars, tutorials, presentations, practicals / demonstrations **30 hours**
2. Student self learning and research time:	Seminar reading and preparation, assignment preparation, background reading, and research activities. **120 hours**
Total hours:	**150 hours**