Module Title: Energy Flows in Buildings: Part B	**Module Code: EV7107** **Level: 7** **Credit: 15** **ECTS credit: 7.5**	**Module Leader**: Frances Hill **Additional tutors:** Bryce Gilroy-Scott Jane Fisher Louise Halestrap Ruth Stevenson Tim Coleridge Alan Owen Siobhan Maderson

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:

Develop a deep understanding of the principles and consequences of energy and mass flows in buildings in terms of the building's orientation and the local climatic conditions.

Build a sound appreciation of how the energy transfers in buildings may be manually calculated, modelled and simulated in computer modelling suites and how this is vital to optimise the design for energy efficiency.

Further hone a systematic, holistic, multidisciplinary and analytical approach to the critical appraisal of passive and energy efficiency design, heat and moisture flows in new builds and renovations, with respect to the demands of climate change adaptation and the principles of sustainability.

Main topics of study:

- Passive solar design
- Thermal mass in buildings
- Energy and Mass flows in Buildings
- Energy Saving in buildings
- Ventilation and cooling
- Principles of lighting
- Solar Gains
- Daylighting, artificial lighting
- Movement of moisture in building fabric
- Relative humidity, internal moisture control and moisture buffering
- Computer simulation of thermal and hygroscopic building performance
- Low and zero carbon buildings, including Passivhaus
- Refurbishment

Learning Outcomes for the module

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

Knowledge

1. Demonstrate a clear understanding of the principles of energy transfers and ventilation, condensation, moisture movements in buildings and passive building services in the context of the design and refurbishment of buildings under an adaptation and sustainability remit

Thinking skills

2. Demonstrate skills in numerical analysis applied to energy and moisture flows in buildings
3. Critically evaluate a building's design or proposed renovations to a building in terms of effectiveness in providing occupant comfort, energy efficiency, potential for rot and decay, wider environmental impacts and resilience to climate change

4. Apply a critical understanding of the general principles of heat transfers, ventilation, condensation and passive building services in the context of the design of buildings and sustainability;.
5. Evaluate, assess and critique theories and designs in the subject area.

Skills for life and work (general skills)

6. Effectively communicate (written and poster) to a wider audience
7. Use IT and computer skills to gather and deploy evidence and data to find, retrieve, sort and exchange new information.

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

The factual content of the module is taught through lectures, seminars, practical workshop, presentations, and tutorials, and throughout this process an active exchange of information, experience and opinions is encouraged. Both theoretical and practical aspects are covered. The summative coursework consists of a case study of a plan for building refurbishment, and a poster presentation based on an aspect 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. Case study – building refurbishment (2,400 words max.)	**80%**	**1,2,3,4,5,6,7**
2. Individual A2 Poster presentation (600 words equivalent)	**20%**	**6**

Reading and resources for the module:

Core

McMullan, R., (2012) *Environmental Science in Building.* 7th Edition, London: Palgrave Macmillan.

Recommended

Clements-Croombe D. (editor) (1997). *Naturally Ventilated Buildings: Buildings for the Senses, Economy and Society*. Abingdon: Spon Press.

Harvey, L. D. D. (2010). *Energy Efficiency and the Demand for Energy Services*. Energy and the New Reality 1. London: Earthscan. (*)

Henson J.L.M. & Lamberts R. (2011). *Building Performance Simulation for Design and Operation*. Abingdon: Spon Press..

Jankovic L. (2012). *Designing Zero Carbon Buildings Using Dynamic Simulation Methods*. Abingdon: Routledge.. (*)

Roaf, S. (2009) *Adapting buildings and cities for climate change : a 21st century survival guide.* 2nd ed. Oxford: Elsevier. (*)

<table>
<tr><td colspan="2">Santamouris M. (editor) (2007). Advances in passive Cooling. (BEST (Buildings, Energy and Solar Technology)). Abingdon: Earthscan.. (*)

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</td></tr>
<tr><td>Indicative learning and teaching time

(10 hrs per credit):</td><td>Activity</td></tr>
<tr><td>1. Student/tutor interaction:</td><td>Lectures, seminar, tutorial, presentation, practical / demonstration

30 hours</td></tr>
<tr><td>2. Student learning time:</td><td>Seminar reading and preparation, Assignment preparation, Background reading, On-line research activities.

120 hours</td></tr>
<tr><td>Total hours (1 and 2):</td><td>150 hours</td></tr>
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