Engineering Tripos Part IIB, 4M19: Advanced Building Physics, 2017-18

Module Leader

Dr M Overend [1]

Lecturers

Dr M Overend, Prof G Hunt and Dr R Choudhary

Timing and Structure

14 lectures (including integrated examples classes) + coursework; Assessment: 100% coursework

Prerequisites

3D8

Aims

The aims of the course are to:

- develop a deep understanding of how fundamental principles of building physics are integrated at the system level to guide the design of zero-carbon built environments

Objectives

As specific objectives, by the end of the course students should be able to:

- evaluate alternative energy systems and buildings technologies against energy consumption for a given context.
- design and evaluate novel systems for low energy built environment.
- have expertise in numerical modelling of energy in the built environment.
- operate equipment and capture data to assess building performance.
- use field measurements to validate building performance models.

Content

Designing sustainable buildings requires making choices among various building materials and components, and more efficient use of energy and natural resources. In order to do so, the building structure, the building fabric and the building services must be understood both in individual details and as interacting systems. For example, the need for energy must be analysed in conjunction with energy production for heating and cooling, distribution, thermal storage, and the end-use in buildings. The module first introduces students to energy efficient building systems and other advanced building physics topics. It subsequently describes energy modelling techniques for analysing buildings as a system of interacting components and processes leading to low energy buildings that satisfy occupant comfort systems and technologies. The module aims to develop a deep understanding of how fundamental principles of building physics are integrated at the system level to guide the design of zero-carbon built environments.

Energy Efficient Building Systems (4L,Dr M Overend; 1L, Prof. E. Mastorakos; 1L, Dr A White; 1L, Prof. A Short; 2L industry speaker)

- Introduction to energy efficient building Systems
- Building envelope systems
- Light and lighting systems
- Heating cooling and ventilation systems
- Fire Engineering
- Acoustics

Building Performance Modelling (4L, Dr R Choudhary; 1L, Prof. K. Steemers)

- Introduction to Building Energy Simulation
- Occupant comfort and behaviour
- Modelling Techniques: transfer equations, network analysis, lumped system analysis
- BES Computer Models: techniques and applications (OOP, Modellica,...)
- Practical Exercise 1: Building performance simulations

Coursework

Students will undertake two tranches of coursework that are both aimed at assessing the performance of an indoor space in terms of energy efficiency and occupant comfort. The first coursework consists of numerical building

performance simulations of specified rooms within CUED. The second coursework consist of field measurements within the specified rooms, where the students will use a range of instruments for characterising the environmental performance and comfort levels. The students will subsequently use the numerical and experimental data from their work to develop evidence-based proposals for improving the energy efficiency and comfort within the indoor space.

All coursework will be submitted at the start of Lent Term.

- Report 1: Building performance simulation workshop (Practical exercises / simulations)
- Report 2: Performance assessment of real-world space based on field measurements.

Booklists

Please see the Booklist for Group M Courses [2] for references for this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

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Links
[1] mailto:mo318@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56291
[3] https://teaching.eng.cam.ac.uk/content/form-conduct-examinations