Engineering Tripos Part IIB, 4D13: Architectural Engineering, 2018-19

Module Leader (Engineering)
Dr R Choudhary [1]

Module Leader (Architecture)
Dr M Ramage [2]

Lecturers
F A McRobie, S Smith, S. Fitzgerald

Timing and Structure
Michaelmas term. 8 afternoons. Assessment: 100% coursework

Prerequisites
[3D3, 3D4, 3D8] useful

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

• have some appreciation of the principles of architectural engineering, with a strong focus on environmental and structural aspects.
• be aware of the various functional requirements of building services and building envelopes, and of how they can be met by combinations of materials and proper construction techniques.
• be aware of current digital and computational techniques used in design analysis.
• design using timber

Content
This module is run in conjunction with the Department of Architecture. CUED students who elect to do this module will work together one full afternoon per week with final year students from the Department of Architecture. The module involves an architectural engineering design exercise, with students working in mixed groups of architects and engineers.

The course focuses on energy-efficient building designs. It also considers structural design -- specifically timber.

Mich 2017 exercise was on designing tall timber buildings. Projects vary from year to year.

The teaching format will be unconventional. Each afternoon will probably begin with a talk by one of the lecturers or by an external speaker. For the remaining class time, students will work (in groups) on developing environmental, structural and other strategies for their design project.

On week 6 of the course, each group will make a presentation of its design (including a physical model) to an assembled group of architectural, structural, environmental experts. Weeks 7-8 will be devoted to developing
detailed design of parts of the project, with students working on their individual reports.

**Course Schedule**

All classes will be in LR3, Inglis Building, Engineering Dept., 2.00-5.00pm Thursdays.

1. **Thursday 4th October**
   
   Course Introduction

   - Lecture 1: Supertall Timber (Michael Ramage)
   - Teams will be formed and the following Project Tasks distributed:

     A: Precedent timber construction materials
     B: Precedent Tall Buildings
     C: Exemplary Tall Timber buildings
     D: Exemplary timber building (not necessarily tall)
     E: Fire Safety in tall buildings
     F: Ventilation of tall buildings
     G: Energy efficiency and sustainability of tall buildings
     H: Façade Design of Tall Buildings
     J: Daylighting and solar control of tall buildings
     K: Site: analysis of climate data of London
     L: Site: Digital 3D Model of the Site & Urban Context
     M: PassiveHaus and other Energy Efficiency Standards
     N: Site: Solar & daylighting Analysis
     N: Site: Local Air Movement Analysis
     O: Urban Design Analysis of the Site

   Teams will upload their documentation by 2 pm, 11th October onto Moodle.

2. **Thursday 11th October**

   - Lecture 2: Timber Engineering (Ed Moseley, Director of Adams Kara Taylor AKT II)
   - Group work

   Project Tasks Due (5% mark)

3. **Thursday 18th October**
Lecture 3: Passive house principles in tall buildings (Ivan Jovanovich, Associate Director of Atelier Ten)  
- Group work

4. Thursday 25\textsuperscript{th} October

- Lecture 4: Urban design lecture (Kevin Flanagan, PLP Architecture)  
- Group work

5. Thursday 1\textsuperscript{st} November

- Lecture 5: Daylighting & Energy Efficiency (Ruchi Choudhary)  
- Group Work

6. Thursday 8\textsuperscript{nd} November

- **Design Review (20\% mark)** Critics: Ron Baker, Kevin Flanagan, Ed Moseley, Simon Smith, Shaun Fitzgerald, Michael Ramage, Ruchi Choudhary, Allan McRobie, Meredith Davey

7. Thursday 15\textsuperscript{th} November

- **Workshop 1: Ventilation Design of tall buildings** (Prof. Shaun FitzGerald, Royal Academy of Engineering Visiting Professor)

8. Thursday 22\textsuperscript{nd} November

- **Workshop 2: Structural Detailing of Timber Buildings** (Simon Smith, Smith & Wallworks)

Coursework

**Coursework:**

- 5\% for week 1 group exercise
- 20\% for the group presentation of the design and the model on week 6
- 15\% for technical manual on 26/11/2018
- 60\% for an individually authored report on developing an aspect of the design and analysis, to be submitted digitally on Moodle by each student by 4.00pm on the first day of the Lent Term.

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<th>Task</th>
<th>Description</th>
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<tr>
<td>Wiki Site (5% mark)</td>
<td>Each team will upload assigned task to the moodle site. Marks will be based on quality and clarity of documentation.</td>
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<tr>
<td>Design Review (20% mark)</td>
<td>Each group will orally present their design proposal, with 2 posters (A1 size) and a model of their building, and/or visual materials to present their design.</td>
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Designs will be judged on creativity and feasibility of the proposal.

Technical Manual (15% mark)

Each group will submit a report of 4 A4 size pages describing technical elements of their design (e.g., structural design, daylighting strategy, ventilation, and energy efficiency). Think of this as a “development proposal brochure” – it has to cover the necessary ground both briefly and in sufficient detail.

5 pm, 26/11/2018
To be uploaded as *pdf on moodle

Individual Report (60% mark)

A report of 4 A4 size pages showing detailed analysis and outcomes of one selected element of the design. The report should clearly explain all relevant assumptions, numerical results, technical figures, with appropriate references. The 4 page report should be complete in itself, and any additional material in the appendices should be strictly supplementary and will not be marked. Secondary but relevant material may be included in the appendices.

Think of this as the detail to accompany the previous “brochure” – if you put all of your group’s reports together, you'd have a complete narrative to describe your proposal in detail.

4 pm, 15/01/2019
This report is to be submitted individually by every student and not as group work, both on paper and moodle.

Architects should submit work to the Faculty Office, Engineers should submit to the Ms. Karen Mitchell, Mezzanine floor of the Inglis Building. Marking is not anonymous, so all students must write their name on the reports.

Booklists
Please see the Booklist for Group D Courses [3] for references for this module.

Examination Guidelines
Please refer to Form & conduct of the examinations [4].

UK-SPEC

The UK Standard for Professional Engineering Competence (UK-SPEC) [5] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes’ (AHEP) document [6] which sets out the standard for degree accreditation.

The Output Standards Matrices [7] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.