

ENGINEERING TRIPOS    PART IIA  
ENGINEERING TRIPOS    PART IIB

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Saturday 6 May 2006    9 to 10.30

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Module 4D13

ARCHITECTURAL ENGINEERING

*Answer not more than **three** questions.*

*All questions carry the same number of marks.*

*The **approximate** number of marks allocated to each part of a question is indicated in the right margin.*

*Attachments: None*

STATIONERY REQUIREMENTS  
Single-sided script paper

SPECIAL REQUIREMENTS  
Engineering Data Book  
CUED approved calculator allowed

**You may not start to read the questions  
printed on the subsequent pages of this  
question paper until instructed that you  
may do so by the Invigilator**

## 1 EITHER

Various innovations in structural and services engineering have been stimulated by the requirements of new types of building. Other innovations have enabled building owners to spend less on their buildings and/or earn more money from them.

Describe FIVE such examples spanning the last three centuries that illustrate this. Include in your answer a description of the innovation and its significance. Illustrate your answer with sketches wherever possible. [100%]

## OR

The owner of a six-storey nineteenth-century factory building wants to refurbish it for use as offices. The building has cast iron beams and internal columns, brick jack-arch floors, masonry load-bearing walls and wrought-iron roof trusses.

Write an outline draft of a report to the owner covering the following issues:

- (a) the suitability of the building for the proposed use; [40%]
- (b) the feasibility of introducing modern features such as lifts, additional stairs, and modern building services; [30%]
- (c) the purpose and the possible outcomes of a detailed investigation of the building by a structural engineer. [30%]

- 2 (a) Outline briefly four factors that frequently combine to make the process of construction unusually difficult. [40%]
- (b) Define 'tolerant' and 'intolerant' construction. [30%]
- (c) What do you understand by the phrase 'characteristic accuracy'? Describe this in terms of walls constructed out of solid brick, precast-concrete storey-height panels and timber frame. [30%]
- 3 (a) Explain the concepts of hazard, vulnerability and risk, and show in general terms how a risk assessment may be performed. [40%]
- (b) What contribution can risk assessment play in reducing the impact of natural hazards? [30%]
- (c) "We must expect more frequent disasters in future" (Munich Reinsurance). Is an increase in the global frequency and scale of natural disasters inevitable? [30%]
- 4 (a) Describe the technical innovations that were first used in the design of:
- (i) the Eiffel Tower; [10%]
- (ii) the Sydney Opera House. [10%]
- (b) How have the new digital technologies changed the process of building design and construction? Illustrate your answer using specific technologies and case studies. [40%]
- (c) What are the key factors driving the development of digital design technologies? Describe the advantages and limitations that this design process imposes on designers and builders. [40%]

**END OF PAPER**

