

**UNIVERSITY COLLEGE LONDON**

*University of London*

**EXAMINATION FOR INTERNAL STUDENTS**

*For The Following Qualification:-*

*M.Sc.*

**ESGE4: Building Solar Design**

COURSE CODE : **ENVSGE04**

DATE : **12-MAY-03**

TIME : **14.30**

TIME ALLOWED : **2 Hours**

**UNIVERSITY OF LONDON**

**MSc DEGREE IN SCIENCE in BUILT ENVIRONMENT 2003**

**for Internal Students of University College London**

**Module ENVS GE 04: BUILDING SOLAR DESIGN**

**Answer TWO questions only. Answer all parts of the questions chosen.**

1. You have been commissioned to design an energy efficient detached house with four bedrooms on a flat and open site in the southern part of the UK. Your client does not mind whether the house has one, two or three storeys, but is very keen that it should use as little energy as possible for space heating.
  - (a) State your views as to whether a house design which claims to use no energy for space heating is possible in the UK and explain why you take these views. *(5 marks)*
  - (b) You are in the process of preparing a report for the first meeting with your client, who wants to know the range of **PASSIVE SOLAR** heating techniques available. Using sketches and diagrams to illustrate your answer, describe the range of possible techniques to heat the house passively. *(15 marks)*
  - (c) The client has heard that **ACTIVE SOLAR WATER** heating systems might be appropriate. Discuss the advantages and disadvantages of these systems for space **AND** domestic hot water heating for a house in the UK. *(10 marks)*
  - (d) It is clear that the shape of the house and the fabric details will critically affect the energy performance of the house. Discuss, using diagrams where appropriate, the way the shape and fabric (other than issues concerning the windows and glazing) impact on the space heating requirements. *(10 marks)*
  - (e) Similarly, using diagrams where appropriate, discuss the way the window and glazing design will affect the energy performance of the house. *(10 marks)*
  
2. Take a non-domestic building you know well, or have studied in detail, which attempts to use a passive or hybrid system to control its internal environmental conditions to reduce the energy that would otherwise be consumed by full mechanical heating and cooling.
  - (a) Describe the building *(10 marks)* and its passive and/or hybrid systems *(15 marks)* in detail, using sketches and diagrams to illustrate your description *(10 marks)*.
  - (b) End by listing the **FIVE** most important factors which have contributed to the success (or failure) of the design intention, giving a brief description of why each helped (or hindered) the overall energy performance. *(15 marks)*

**TURN OVER**

3. (a) Explain how heat is transferred through a double glazed window unit, consisting of two sheets of clear glass with an air filled cavity between. (10 marks)
- (b) Explain how the glazing referred to in (a) can be modified to reduce heat loss in winter from a building in the UK. (20 marks)
- (c) The window has often been likened to a filter. Explain in what ways contemporary glazing and shading systems act as filtration systems. (20 marks)
4. (a) The solar constant is  $1.37 \text{ kW/m}^2$ . Explain why the average solar radiation falling on the surface of the UK amounts to approximately  $100 \text{ W/m}^2$ . (10 marks)
- (b) A new  $4 \text{ m}^2$  solar collector system is being sold in the UK. The manufacturer claims, without providing evidence, that it will save home owners £500 per annum in their fuel bills and last for 20 years. Assuming that the most expensive form of fuel is electricity at a cost of £0.07 per kWh, comment on these claims. (15 marks)
- (c) For a flat plate solar water collector, what factors affect its efficiency? Explain why. (15 marks)
- (d) A manufacturer of a parabolic concentrating collector has tested the annual efficiency of the system in the desert as being 70%, meaning that 70% of the solar energy incident on the concentrator is converted to heat energy. How would you expect the annual efficiency to change if the collector was tested in the UK and why? (10 marks)

**END OF PAPER**