

**UNIVERSITY COLLEGE LONDON**

University of London

**EXAMINATION FOR INTERNAL STUDENTS**

For The Following Qualification:–

*M.Sc.*

**ESGE4: Building Solar Design**

**COURSE CODE : ENVSGE04**

**DATE : 09-MAY-05**

**TIME : 14.30**

**TIME ALLOWED : 2 Hours**

**UNIVERSITY OF LONDON**

**MSc DEGREE in SCIENCE in BUILT ENVIRONMENT 2005**

**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. (a) When referring to psychrometric charts, the term “climatic envelope” is sometimes used. Explain the term “climatic envelope”, illustrating your answer with a rough sketch of a psychrometric chart showing the approximate climatic envelope for a “hot, dry” climate, such as that of Phoenix, Arizona, USA. Also mark on the chart an approximate zone in which the majority of people would feel thermally comfortable. On your sketch it is not necessary to place exact values. (10 marks)
- (b) Using sketches and diagrams to illustrate your answer, describe the range of possible constructional techniques to passively heat (20 marks) and cool (20 marks) a house in a “hot, dry” climate. In your answer, discuss the range of options that are available and explain how these options can effectively improve indoor thermal comfort, and indicate what influence these strategies might have on the layout and construction of the dwellings.
2. (a) Explain how heat is transferred through a basic double glazed window unit, consisting of two sheets of standard clear glass with an air filled cavity between. (10 marks)
- (b) Explain in what way low-emittance coatings reduce the U-value of glazing systems. (10 marks)
- (c) Explain how the glazing referred to in (a) can be modified most appropriately for use in a *heating* dominated climate. (15 marks)
- (d) Explain how the glazing referred to in (a) can be modified most appropriately for use in a *cooling* dominated climate. (15 marks)
3. Select a well-known non-domestic building which attempts to use passive or hybrid systems to reduce its overall energy consumption.
- (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**

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) Either water or air can be used as the heat transfer fluid in a flat plate solar collector. Explain the advantages and disadvantages of each and the applications for which each type is most suitable. (10 marks)
- (c) For a flat plate solar water collector, what factors affect its efficiency? Explain why. (15 marks)
- (d) A new  $4 \text{ m}^2$  solar collector system is being sold in the UK. Estimate the maximum annual financial savings that such a system might realistically provide for a household in the UK assuming that it is replacing the most expensive form of heating fuel (electricity) at a cost of  $\text{£}0.07$  per kWh. Comment on the simple payback time for the system if the initial cost of the system is  $\text{£}1500$ . (15 marks)

**END OF PAPER**