

UNIVERSITY COLLEGE LONDON

University of London

EXAMINATION FOR INTERNAL STUDENTS

For The Following Qualification:–

M.Sc.

Building Solar Design

COURSE CODE : BENVEE03

DATE : 08-MAY-06

TIME : 14.30

TIME ALLOWED : 2 Hours

University of London

UNIVERSITY COLLEGE LONDON

MSc DEGREE in SCIENCE in BUILT ENVIRONMENT 2006

Module BEN VE E03: BUILDING SOLAR DESIGN

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

1.
 - (a) Explain briefly the concept behind “building bioclimatic design”. (8 marks)
 - (b) Explain the term “climatic envelope”, illustrating your answer with a rough sketch of a psychrometric chart showing the approximate envelope for London, UK. (8 marks)
 - (c) Sketch the climatic envelopes for i) a typical hot dry climate and ii) a typical warm humid climate, explaining why the envelopes have the form they have. (10 marks)
 - (d) Discuss how an architect might reduce the amount of thermal discomfort in summer that will occur in passively cooled small domestic buildings in a hot dry climate. Your discussion should at least include issues such as layout, materials and ventilation. (12 marks)
 - (e) Discuss how an architect might reduce the amount of thermal discomfort in summer that will occur in passively cooled small domestic buildings in a warm humid climate. Your discussion should at least include issues such as layout, materials and ventilation. (12 marks)

2. You have been appointed as the energy consultant to an architectural practice, which has been commissioned to design 30 new self-contained apartments on a site in central London, UK. The idea is that the apartments should use as little winter heating energy as possible and not overheat in summer. You have been asked to brief the design team on the range of options available to achieve these aims.
 - (a) As part of the briefing process, write a short report (which should be illustrated where appropriate) highlighting the major issues that need to be considered by the design team to achieve the project aims. (35 marks)
 - (b) You have been asked whether it is possible to achieve a design which uses no energy for space heating. State your views as to whether a dwelling design which claims to use no energy for space heating is possible in London and explain why you take these views. (15 marks)

TURN OVER

3. (a) Discuss briefly the physical mechanisms by which heat is transmitted through double glazing. (15 marks)
- (b) Explain how low-emissivity (low- ϵ) coatings reduce the overall U-value of glazing. (5 marks)
- (c) Sketch a graph to compare how the transmittance of 'solar control glass' and 'conventional low-emissivity coated glass' varies with wavelength. On your sketch, it is not necessary to place exact numerical values but some indication should be given. Describe how the performance of these two types of glazing differs. (10 marks)
- (d) Discuss briefly the functions that a window must perform in a passively solar heated house. (10 marks)
- (e) Explain in detail why the maximum allowable air temperature for a passively cooled office building in summer is usually expressed differently to that for an air conditioned office building in the same location. (10 marks)
4. (a) Explain why 1 m^2 of horizontal surface in the UK receives about one tenth of the power (when averaged over a year) of the solar constant. (5 marks)
- (b) Explain why the efficiency of a solar collector depends on the temperature difference between the ambient air and the collector water. (5 marks)
- (c) Draw a schematic graph showing how you would expect the efficiency of a flat plate solar collector to change with water temperatures (for a given air temperature) when using the following types of glazing (10 marks):
- i) single
 - ii) double
- (d) Why do most applications of solar energy require some form of energy storage? (5 marks)
- (e) If you had a cubic water store which had sides of three metres and you doubled the length of each side, what impact would this have on the rate of cooling? Explain your answer. (15 marks)
- (f) By how much would you expect the rate of cooling to change if you doubled the insulation thickness of the store from 15 to 30 cm? Explain your answer. (10 marks)

END OF PAPER