UNIVERITY OF BATH
DEPARTMENT OF ARCHITECTURE AND CIVIL ENGINEERING **FIRST YEAR**
BUILDING ENVIRONMENTAL ENGINEERING 1 **QUESTION SHEET**

Solar radiation

1 Consider the location of Bath which is at a Latitude of 51.3 N

a) Determine the solar irradiance on a horizontal roof on the,

- i) Summer solstice at solar noon,
- ii) Winter solstice at solar noon,
- iii) Equinoxes at 9-00am and 5pm solar time.

b) Determine the solar irradiance on a south facing façade at solar noon during the,

- i) Summer solstice,
- ii) Equinoxes,
- iii) Winter solstice.

c) Determine the solar irradiance on a west facing façade at,

- i) 3pm on the Winter Solstice,
- ii) 3pm at the Equinoxes,
- iii) 3pm on the Summer Solstice.

d) Determine the approximate times of the maximum irradiance on,

- i) A west facing façade,
- ii) A north facing façade,
- iii) A south facing façade,
- iv) An east facing façade.

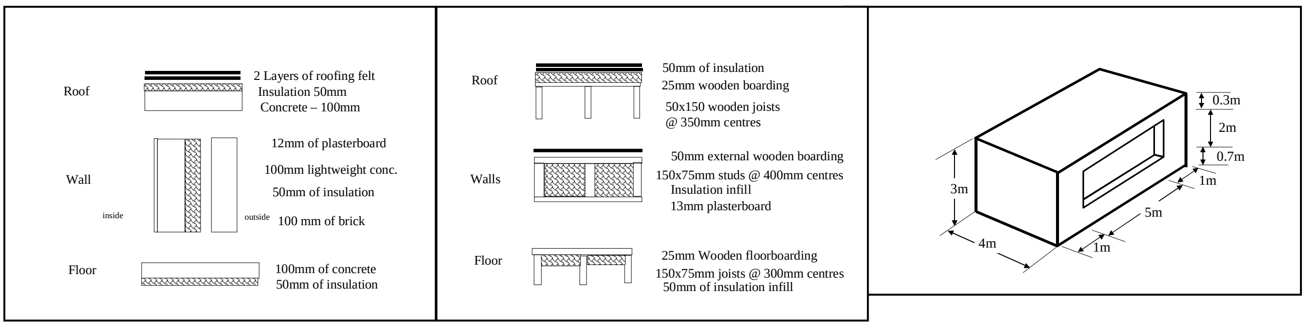
2 Calculate the shading due to the 350mm deep reveals of a window 1m high by 0.5m wide for the two solar altitudes of 30 and 60 with solar wall azimuth angles of 0 and 45.

3 Calculate the solar gain coming through a 10m^2 window at 3pm solar time during the Spring Equinox if the orientation is South West and 70% of incident radiation passes through the window.

4 A green house at the University of Bath has a floor of 3m by 2m and a height to the eves of 2m and 3m to the ridge. If it is assumed that all the radiation incident on the floor is immediately converted to an internal heat gain, then calculate the number of air changes needed to limit to 10 C the increase in air temperature in the green house at solar noon on the Summer Solstice. Assume that the heat is lost through ventilation and by conduction through the glass that has a U-value of 5 W/m^2.

5 If it is assumed that the Earth absorbs 90% of the incident solar radiation of 1360 W/m^2, then calculate its equilibrium temperature if it is assumed to radiate as a black body.

6 Calculate the storage value C for the two constructions of a simple building shown below;



Comment upon the effects of C.