

UNIVERSITY OF RUHUNA
SECOND EXAMINATION IN B.Sc. GREEN TECHNOLOGY (PART II)- September 2020

Green Building Designing (ID2201)

Time 2 ½ hrs

Answer all questions.

Use the given answer book to answer the questions.

All questions carry equal marks.

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01. (a) It is believed that Building sector contributes for more than 40% of the Global CO₂ emissions. Briefly explain how buildings and constructions together may contribute for global warming. You may use examples to support your answer.
- [Marks 30]
- (b) Green building concepts offer significant benefits over traditional buildings. Briefly describe what are "Direct benefits", "Regional benefits" and "Global benefits" of Green Building Concepts.
- [Marks 30]
- (c) There are several principles applied on sustainable construction. List 5 such principles.
- [Marks 15]
- (d) There are 4 basic stages of a building life cycle. Briefly explain how we can apply sustainable construction practices within these 4 stages of building life cycle.
- [Marks 25]
02. Green Building should be designed to maximize the use of daylight in order to reduce energy use. A double story apartment block with 2 identical rooms and windows is shown in Figure 01. Both rooms have a plan of 5m x 10m and a height of 3m as shown in the figure. There are 2 windows of 1.5m x 2.62m at the height of 0.7m in each room. The Average Daylight Factor (ADF) is used to estimate the daylight in the design of this room.
- (a) Determine the ADF for the upstairs room.
- [Marks 25]
- (b) Determine the ADF for the downstairs room.
- [Marks 25]
- (c) Calculate the average light levels in both rooms in conditions of standard overcast sky of 5000 lux.
- [Marks 30]
- (d) Briefly explain how to increase the daylight in this building
- [Marks 20]
- You may assume following data:

- The diffuse light transmittance of the glazing = 0.75
- Reflectance of the ceiling = 0.8
- Reflectance of the wall = 0.7
- Reflectance of the floor = 0.3
- Reflectance of the window = 0.1

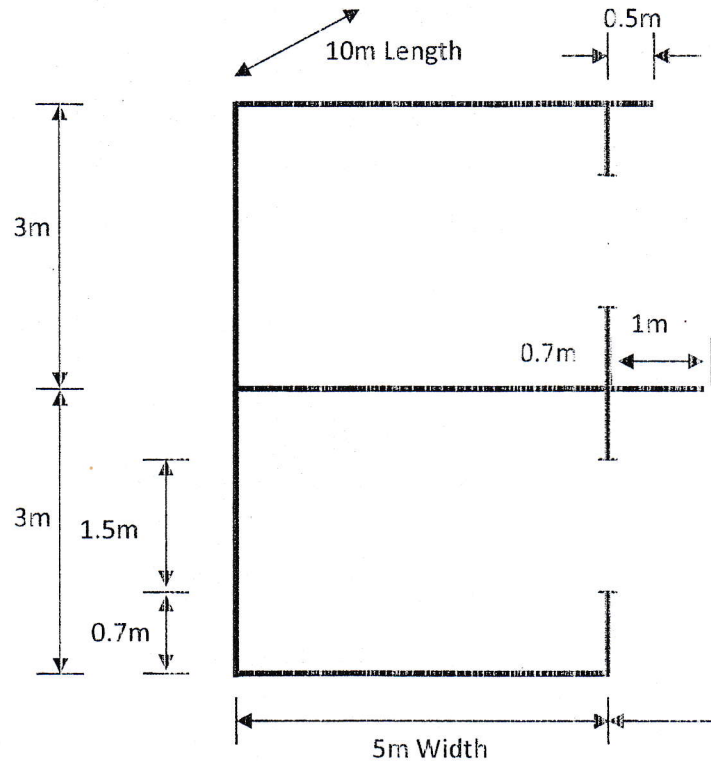


Figure 01

03. The determination of the thermal properties of a building envelope is fundamental for the correct design of energy efficient constructions. A building has a plan 20m x 40m and a height of 4m. The external walls are of 102.5 mm brickwork with 100 mm air cavity and 13 mm dense plaster internally. 40% of the external walls are made of single glazing with emissivity of 4.8 W/m²K.

(a) Determine the "U- value" of the existing external walls of this building

[Marks 30]

(b) Determine the "U- value" of the existing external walls if the cavity is filled with insulation.

[Marks 30]

(c) Calculate the potential saving of heat loss (in percentage) of these external walls after the installation of the additional insulation, assuming the new thermal transmittance of the wall is

0.18 W/m²K and the glazing is changed to double glazing with emissivity of 1.2 W/m²K. Outside temperature is taken as 0°C and inside temperature is taken as 20°C.

[Marks 40]

You may assume following data:

Thermal conductivity of brickwork = 0.700 W/mK

Thermal conductivity of timber cladding = 0.120 W/mK

Thermal conductivity of insulation = 0.035 W/mK

Outside surface resistance = 0.050 m²K/W

Inside surface resistance = 0.100 m²K/W

Resistance for 100 mm air cavity = 0.18 m²K/W

Resistance for 13 mm dense plaster = 0.030 m²K/W

04. (a) An institute with 30 staff members in an area with average monthly rainfall 70 mm is planning to install a rainwater harvesting system at their institute to use rainwater for non-potable use; toilet flushing, car washing, gardening, accounted as 50L per capita/day. They are going to use building roof as the catchment area. Calculate the minimum roof “footprint” area that need for rainwater harvesting to fulfil all the non-portable water needs in this institute. You may assume a suitable runoff coefficient.

[Marks 20]

- (b) Briefly explain advantages and disadvantage of “Rainwater Harvesting” as an alternative water usage practice.

[Marks 20]

- (c) Green Roofs” are one of the most exciting developments in sustainable building design. Briefly explain about the important component of a Green Roof.

[Marks 20]

- (d) “Sustainable Sites” is an important aspect in the rating system for built environment of Green Building Council of Sri Lanka (GBCSL). Briefly explain all the subcategories under the “Sustainable Sites”. You may use possible examples.

[Marks 40]

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