



*Leaving Certificate Examination, 2010*

# *Construction Studies*

## *Theory - Higher Level*

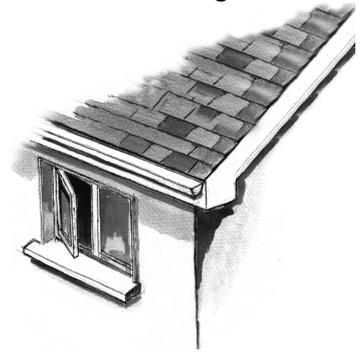
*(300 marks)*

*Wednesday, 23 June*  
*Afternoon, 2:00 - 5:00*

- (a) Answer **Question 1** and **four** other questions.*
- (b) All questions carry equal marks.*
- (c) Answers must be written in ink.*
- (d) Drawings and sketches to be made in pencil.*
- (e) Write the number of the question distinctly before each answer.*
- (f) Neat freehand sketches to illustrate written descriptions should be made.*
- (g) The name, sizes, dimensions and other necessary particulars of each material indicated must be noted on the drawings.*

1. The sketch shows portion of an external wall, roof and a window of a dwelling house. The external wall is a 350 mm concrete block wall with an insulated cavity. The roof has prefabricated trussed rafters, it is slated and has a pitch of 30 degrees. The house has an internal span of 6.0 metres. The window is an outward opening triple-glazed wooden casement window and is 600 mm in height. The fixed frame of the window is 150 mm × 80 mm.

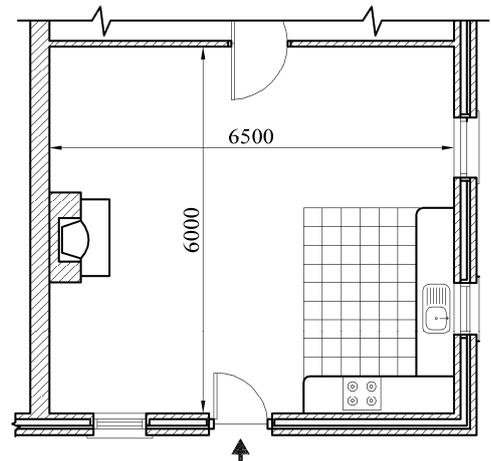
- (a) To a scale of 1:10, draw a vertical section through the external wall, window and roof structure. The section should show the typical construction details from 300 mm below the concrete cill, through the fixed frame of the window and include the roof to the level of the ridge. Include **four** typical dimensions of the roof structure.
- (b) Indicate clearly on the drawing how the cavity is closed at wallplate level.



*Note:* Show the details for one external wall, one half of the roof from eaves to ridge level and include three courses of slate at eaves.

2. The accompanying diagram shows an open-plan living, dining and kitchen space suitable for a person in a wheelchair. The floor is an insulated solid concrete ground floor.

- (a) Using notes and **freehand sketches** show the design detailing at the entrance door to ensure that rainwater is removed from the threshold area and that the entrance is suitable for a person in a wheelchair.
- (b) From the given diagram, select any **two** areas that need specific consideration to ensure suitability for a person in a wheelchair. For **each** area selected, using notes and **freehand sketches**, show the specific design detailing that ensures ease of use for a person in a wheelchair. Indicate on your design sketches typical dimensions as appropriate.



3. The external wall of a dwelling house built in the 1970s is a 300 mm concrete block wall with 40 mm expanded polystyrene insulation in the cavity. It has been decided to upgrade the thermal properties of the external wall by using either:

- an internal insulation system *or*
- an external insulation system.

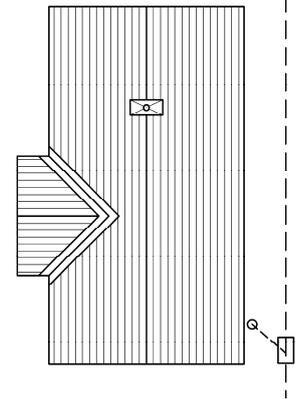
- (a) For **each** of the insulation systems outlined above, show using notes and **freehand sketches**, one method of applying the insulation material. For **each** insulation system, include the following in your sketches:

- method of fixing
- insulation material and its thickness
- surface finish.

- (b) Discuss in detail **two** advantages of each system of insulation and recommend a preferred system of insulation for the house outlined above.

4. (a) Discuss, using notes and *freehand sketches*, **three** functional requirements of a below ground drainage system to ensure the safe removal of sewage from a domestic dwelling.

(b) The accompanying sketch shows the location of a manhole at the intersection of a branch drain and a main drain in a below ground drainage system for a domestic dwelling. Using notes and *freehand sketches*, show the typical construction details through the manhole from the foundation to the manhole cover. Indicate on the sketch the typical dimensions.



(c) Using notes and *freehand sketches*, describe in detail **one** test that may be carried out to ensure that the below ground drainage system is watertight.

5. (a) Calculate the U-value of an uninsulated external solid concrete wall of a dwelling house built in the 1950s given the following data:

External render	thickness	16 mm
Solid concrete wall	thickness	225 mm
Internal plaster	thickness	13 mm

**Thermal data of external wall of house:**

Resistivity of the solid concrete wall	(r)	1.190 m °C/W
Resistivity of external render	(r)	2.170 m °C/W
Resistivity of internal plaster	(r)	6.250 m °C/W
Resistance of external surface	(R)	0.048 m <sup>2</sup> °C/W
Resistance of internal surface	(R)	0.122 m <sup>2</sup> °C/W

(b) Phenolic foam insulation is to be fitted to the external surface of the solid concrete wall. Given the conductivity (k) of phenolic foam as 0.025 W/m °C, calculate the thickness of phenolic foam required to achieve a U-value of 0.27 W/m<sup>2</sup> °C.

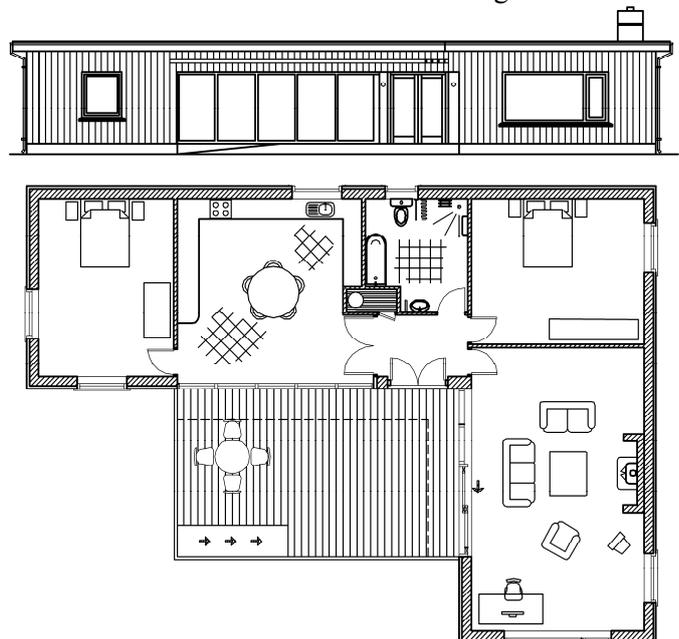
(c) Discuss in detail, using notes and *freehand sketches*, the importance of thermal mass in improving the thermal performance of a dwelling house.

6. The drawing shows the design of a timber frame house with an external wooden cladding and a flat roof. The house is designed to have low environmental impact.

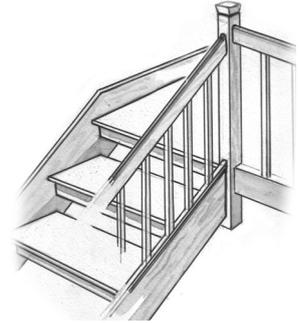
(a) Discuss in detail, using notes and *freehand sketches*, **three** design features that contribute to reducing the environmental impact of the house shown.

(b) Discuss in detail the importance of **each** of the following when choosing materials for an environmentally sustainable house:

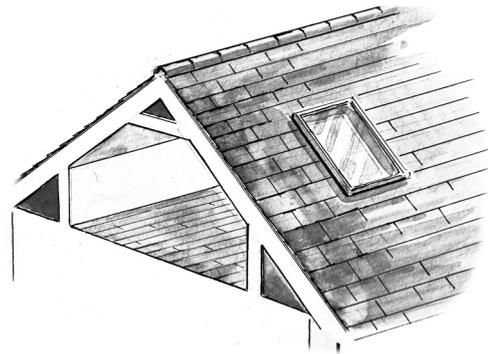
- renewable
- durable
- locally sourced.



7. The top portion of an open riser timber stairs is shown in the accompanying sketch. The first floor landing has a suspended timber floor with 25 mm hardwood flooring on timber joists and a plasterboard ceiling beneath. The newel post is 100 mm × 100 mm.

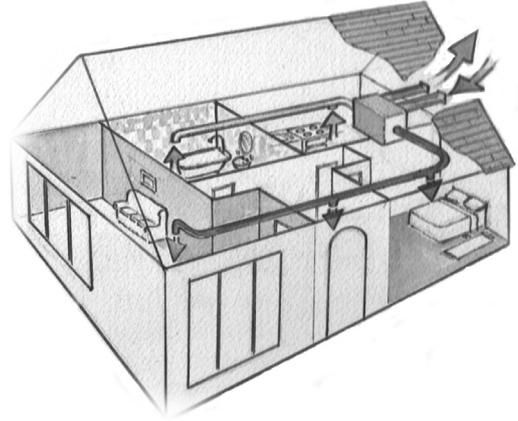


- (a) To a scale of 1:5 draw a vertical section through the top three steps of the stairs and landing. Show the newel post, balusters and handrail of the stairs. Indicate on the drawing the:
- handrail height to stairs
  - handrail height to landing
  - spacing between balusters.
- (b) Using notes and *freehand sketches*, show **two** safety features in the design of an open riser stairs to ensure that the stairs is safe for all users.
8. (a) Determine by degree of efficiency method, or by any other suitable method, the approximate size of a vertical window for a living room 5.0 metres long by 3.8 metres wide requiring an average illumination of 150 lux on the working plane. Assume an unobstructed view and the illumination of a standard overcast sky to be 5000 lux.
- (b) Discuss in detail, using notes and *freehand sketches*, **two** design considerations for a contemporary window frame and glazing system that will ensure the high thermal performance of both:
- the window frame *and*
  - the glazing system.
- (c) Outline **two** environmental considerations that should be taken into account when recommending a preferred material for the window frame.
9. (a) Discuss in detail, using notes and *freehand sketches*, **three** functional requirements of an attic space suitable for use as a living area.
- (b) The sketch shows the outline of an attic space in a new house. Identify **two** possible air leakage routes in the attic space. Using notes and *freehand sketches*, show clearly the correct design detailing that will improve the airtightness level at each air leakage route identified. Specify the materials used to achieve satisfactory airtightness levels.
- (c) Discuss **two** advantages of improved airtightness in the attic space.



10. (a) Using notes and *freehand sketches*, discuss in detail the importance of any **two** of the following in the design of a Passive House:

- shape and form of the house
- continuity of insulation
- reduced thermal/cold bridging.



(b) The layout of a Mechanical Heat Recovery with Ventilation system (MHRV) for a Passive House is shown in the accompanying sketch. Explain, using notes and *freehand sketches*, the operating principles of such a system and discuss **two** advantages of this system for a Passive House.

(c) Show, using notes and *freehand sketches*, **two** design details that would help prevent the possible overheating of a Passive House in summer.

**OR**

10. “In the increasingly urbanised world of the 21<sup>st</sup> century, a major challenge is to find solutions to the problems facing our towns and cities – the control of sprawl, sustainable growth, integrated transport systems and better-quality urban environments and public realms. Cities and towns that are diverse, varied in use, walkable, human scaled and identifiable by the high quality of their public realm can contribute to the process of creating sustainable urbanism. The challenge for all citizens is to make our towns and cities viable in the long term, environmentally and socially, as well as economically. There will be no sustainable world and no sustainable country without sustainable cities and towns”.

Sustainable Urbanism: creating communities for the knowledge economy: by Anthony Reddy in *The New Housing 2*, Royal Institute of Architects of Ireland 2009.

Discuss the above statement in detail and propose **three** guidelines that would help create environmentally sustainable urban development in Ireland.

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