Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2018

Construction Studies

Theory - Higher Level

(300 marks)

Friday, 15 June
Afternoon, 2:00 to 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 are 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. A front porch projects 1.2 metres from the external wall of a dwelling house, as shown. The insulated wall of the porch is of timber frame construction with a rainscreen of vertical cedar cladding. The studwork is 250 mm × 50 mm.
The external wall of the house is a 400 mm rendered concrete block wall with a full-fill insulated cavity. The lean-to roof of the porch is an insulated slated roof and has a pitch of 30°. Insulated plasterboard is also fixed to the underside of the sloping rafters.

(a) To a scale of 1:5, draw a vertical section through the porch showing the external wall of the porch, the sloping roof, and the front wall of the house. Show the typical construction details of the porch from a point 300 mm below the wallplate, through the sloping rafters to a level 300 mm above and 200 mm below the abutment of the roof and the front wall of the house. Show **three** courses of slate at eaves.
It is not necessary to show window or door details.

(b) On your drawing, show the typical design detailing to prevent the ingress of rainwater between the roof of the porch and the front wall of the house.

Note: *Position your drawing carefully to ensure that the answer fits on the drawing sheet.*

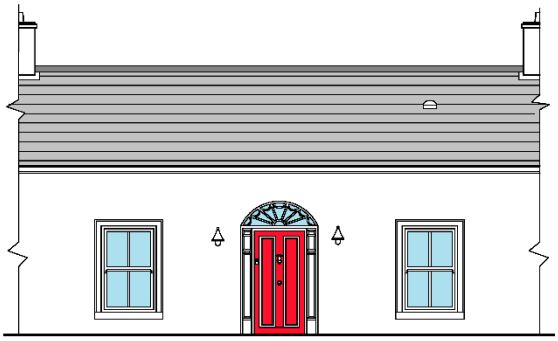
2. **(a)** Discuss in detail **one** possible safety risk associated with **each** of the following tasks on a construction site:

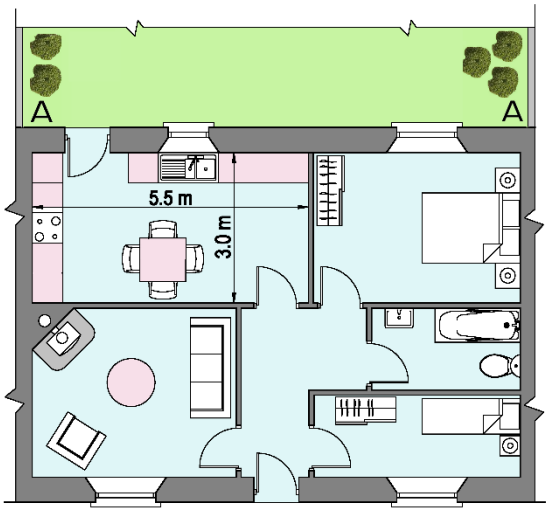
- excavating where there are underground electrical cables
- working in a deep trench
- working at height when slating a roof.

(b) For **each** risk discussed at **2(a)** above, show, using notes and freehand sketches, **two** best practice guidelines that should be observed to reduce the possibility of injury to a worker undertaking each task.

(c) Discuss in detail **three** strategies that would promote a positive safety culture among workers on a construction site.

3. The drawing shows the ground floor plan and the front elevation of a terraced cottage. Also shown is a portion of the rear garden. The walls of the cottage are of random rubble construction and are rendered. The rear wall **A-A** is south facing. To provide additional living space, and to enhance the health and wellbeing of the occupants, it has been decided to build a single-storey extension, not greater than 18.0 m^2 in area, to the rear of the cottage.





(a) Discuss **three** considerations that should be taken into account in the design of the extension to ensure that the health and wellbeing of the occupants is enhanced by building the extension.

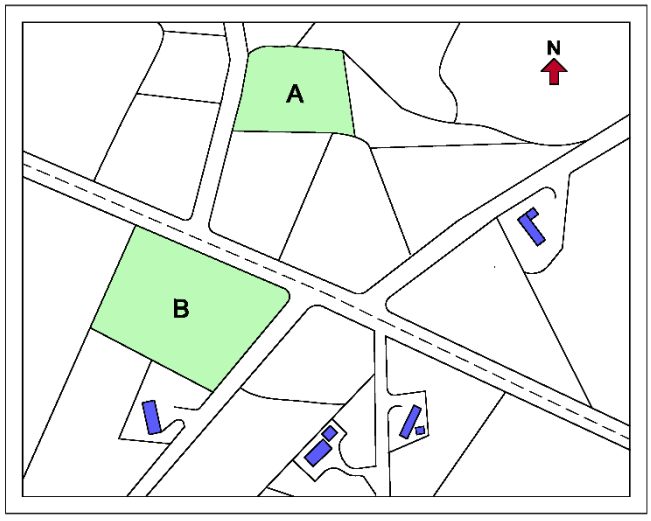
(b) Using notes and freehand sketches, show a proposed design layout for the extension and the necessary modifications to the existing layout of the cottage.

(c) Discuss how your proposed design meets **each** consideration discussed at **3(a)** above.

4. **(a)** Using notes and freehand sketches, discuss the importance of **each** of the following when identifying a suitable site for a new house in a rural landscape:

- characteristics of existing dwellings
- characteristics of the proposed site.

(b) An extract from a site location map is shown. **A** and **B** are possible sites for a new house. Select your preferred site and discuss **three** considerations you took into account when selecting your site.



(c) Draw a well-proportioned sketch of your selected site and the immediate boundaries.

On your sketch, show a preferred:

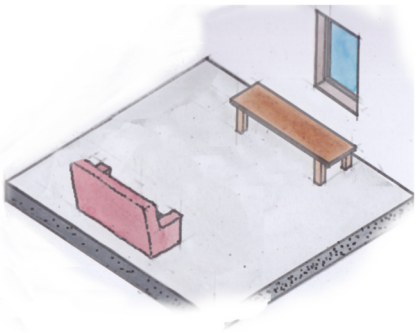
- location and orientation of a house on the site
- layout of the road entrance and the driveway to the house.

For **each** of the above, justify your design choices.

5. A house built in the 1970s has an uninsulated solid concrete ground floor, as shown, with a sand/cement fine screed finish.

(a) Calculate the U-value of the uninsulated concrete ground floor, given the following data:

Sand/cement fine screed	thickness	50 mm
Concrete floor slab	thickness	100 mm
Radon barrier	thickness	0.25 mm
Sand blinding	thickness	40 mm
Hardcore	thickness	200 mm
Subsoil	thickness	300 mm



Thermal data of the concrete ground floor:

Resistance of internal top surface of floor	(R)	0.104	m^2	°C/W
Resistivity of fine screed	(r)	0.710	m	°C/W
Conductivity of concrete floor slab	(k)	1.280	W/m	°C
Conductivity of radon barrier	(k)	0.250	W/m	°C
Conductivity of sand blinding	(k)	0.160	W/m	°C
Conductivity of hardcore	(k)	1.350	W/m	°C
Conductivity of subsoil	(k)	1.600	W/m	°C

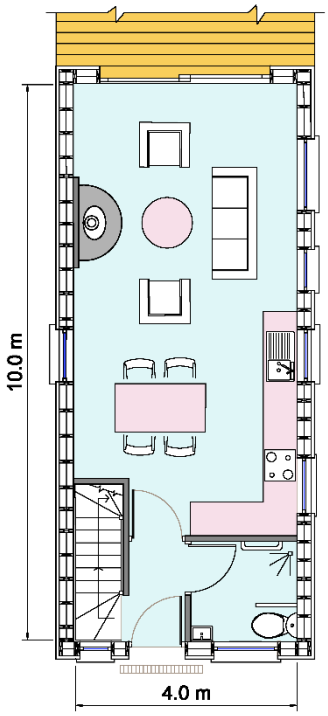
(b) Using the U-value of the concrete floor obtained at **5(a)** above and the following data, calculate the cost of heat lost annually through the uninsulated concrete floor slab:

- dimensions of floor slab — 6.0 metres × 12.0 metres
- average internal temperature — 21 °C
- average temperature of subsoil — 5 °C
- heating period — 10 hours daily for 38 weeks per annum
- cost of oil — 96 cent per litre
- calorific value of oil — 37350 kJ per litre
- 1000 Watts — 1 kJ per second.

(c) It is proposed to redesign the above floor and upgrade its thermal properties to meet the Passive House standard by including expanded polystyrene in the design of the floor.

Given the thermal conductivity (k) of expanded polystyrene as 0.037 W/m °C, calculate the thickness of expanded polystyrene required to achieve a U-value of 0.15 W/m^2 °C.

6. A young couple have obtained planning permission to build an eco-friendly house, with internal dimensions of 10.0 m × 4.0 m, as shown. There are two bedrooms and a bathroom upstairs. The couple have an interest in house construction and wish to self-build their house with the help of neighbours, family and friends. They have also engaged professional design supervision and an electrician. The house is of timber frame construction throughout, with an external rainscreen of native larch.



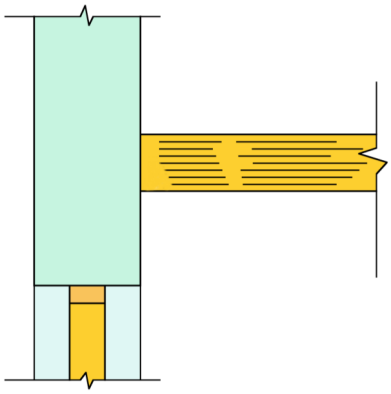
(a) Discuss **two** advantages and **two** disadvantages of self-build as a method of building a house.

(b) Discuss in detail, using notes and freehand sketches, **three** features of the design shown that make the house suitable as a self-build project.

(c) Suggest, using notes and freehand sketches, **two** modifications to the existing design that would further reduce the environmental impact of the house and help meet the nearly Zero Energy Building (nZEB) requirements.

Justify your design choices.

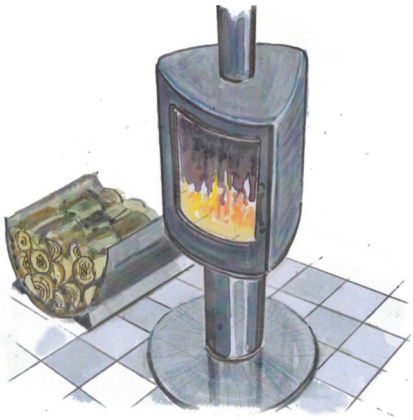
7. The main entrance door to a two-storey dwelling house is a high performance insulated wooden door, with vertical sheeting on both sides. The doorframe is thermally broken and is fitted in a 450 mm external concrete block wall with a full-fill insulated cavity. This external wall supports the first floor joists, as shown in the accompanying outline drawing. The first floor is a 25 mm floating wooden floor, on a 20 mm plywood deck, on 200 mm × 40 mm wooden joists, with a plasterboard ceiling beneath.



(a) To a scale of 1:5, draw a vertical section through a portion of the external wall, doorframe, door, first floor joists, and floor. Show the typical construction details from a level 400 mm below the top of the door to a level 300 mm above the first floor joists.

(b) Show clearly on your drawing best-practice design detailing to ensure airtightness at the junction of the external wall and the first floor.

8. A wood-burning stove as shown, combined with a solar collector, is used to provide central heating and hot water for a compact three bedroom, two-storey house.



(a) Using notes and a single-line diagram, show a typical design layout for both the central heating **and** the hot water systems. Show **two** independently controlled heating zones, one on each floor. Include **three** radiators on each floor and give the typical sizes of the pipework.

(b) Using notes and freehand sketches, describe **two** features that ensure that the system operates safely at all times. Discuss the importance of **each** safety feature outlined.

(c) Using notes and freehand sketches, show **two** design considerations that should be taken into account when selecting a preferred location of a chimney for the stove. Discuss the importance of **each** consideration outlined.

9. **(a)** Discuss in detail using notes and freehand sketches, **three** functional requirements of an attic space suitable for use as a bedroom.

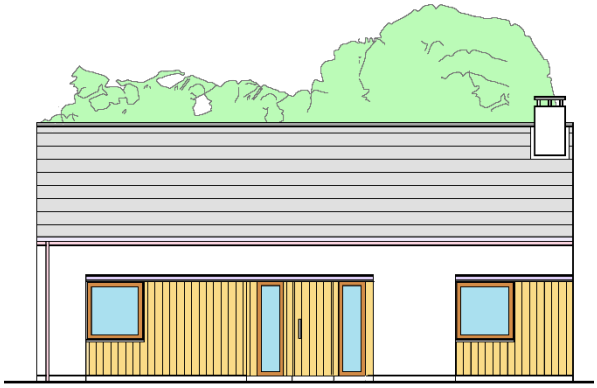
(b) A traditional cut roof, which is slated and has a pitch of 45°, is designed to provide a well-insulated bedroom in the attic space, as shown. Using notes and freehand sketches, show the typical design detailing for such a roof. Include the stud side walls and the insulation.
Show clearly the design detailing necessary to ensure the structural stability of the roof.
Label the main components and give their typical dimensions.

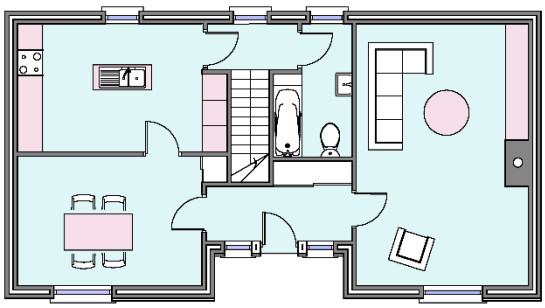
(c) On your sketch, show **one** design detail to prevent air leakage at the junction of the stud side wall and the sloped ceiling.

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

- space heating energy demand
- building form
- thermal bridging.

(b) The drawing shows a preliminary design of a dwelling house, having two bedrooms and a bathroom upstairs. The clients wish to upgrade this design to meet the Passive House standard.
Show, using notes and freehand sketches, **three** modifications you would make to this design to help meet the Passive House standard. Justify your design choices.





(c) Show, using notes and freehand sketches, a preferred orientation for your upgraded design.
Include the sun path in your sketch and discuss how your preferred orientation ensures the optimum thermal performance of the house.

***Note**: It is not necessary to show the furniture.*

OR

10. Green design is about being green, rather than simply appearing to be green. So greening your house is about more than just buying all sorts of expensive 'eco-bling' and adding it to your house. Ironically, that could be just another display of consumerism. Rather, greening your house is about making responsible environmental choices based on what you *want* to do, what you *can* do and what you can *afford*. This means that - before we get into the minutiae of sustainable building materials - we should address some fundamentals, chief among which is the need to build modestly and source locally.

From: **contemporary design secrets: the art of building a house in the countryside**
Jane Burnside (2013)
Published by: BOOKLINK. ISBN 978-1-906886-42-4

Discuss the above statement in detail and propose **three** best practice guidelines that would promote green, sustainable housing in Ireland.

There is no examination material on this page