



**Coimisiún na Scrúduithe Stáit**  
***State Examinations Commission***

***Leaving Certificate Examination, 2014***

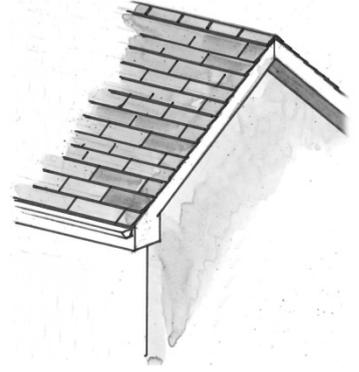
***Construction Studies***  
***Theory - Higher Level***

*(300 marks)*

***Friday, 13 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 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.*

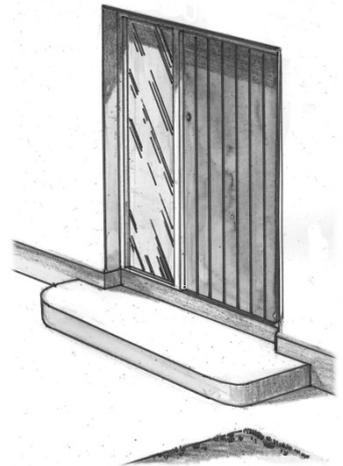
1. The sketch shows portion of the roof and external wall of a single-storey dwelling house. The house has an internal span of 6.0 metres. The external wall is of timber frame construction, with a rendered concrete block outer leaf, a 200 mm timber frame inner leaf and a 60 mm insulated service cavity. The roof, which is slated, has prefabricated trussed rafters and is pitched at 30 degrees.



- (a) To a scale of 1:10, draw a vertical section through one external wall and one rafter length. Show the typical construction details from 400 mm below the ceiling joists, through the external wall and eaves, up to ridge level. Include the ventilation path to the roof and show **three** courses of slate at eaves. Include **three** typical dimensions of the roof structure.
- (b) Indicate clearly the design detailing to ensure airtightness at the junction of the ceiling and the external wall.
2. The sketch shows the main entrance to a dwelling house. It has been decided to upgrade this entrance to ensure that everybody can enter the house without special assistance.

The following is to be provided at the main entrance:

- threshold and access ramp
- weather protection
- suitable lighting.

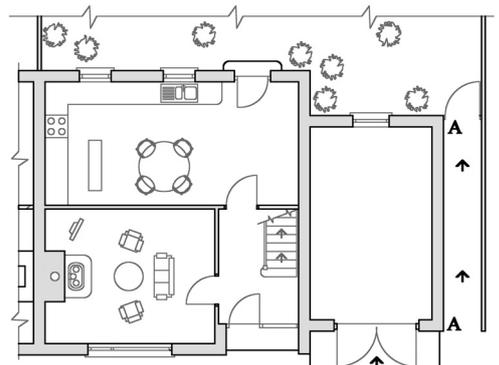


- (a) For **each** of the above, using notes and freehand sketches, show appropriate design detailing to ensure that the house is accessible to all. Justify your design choices and include dimensions as appropriate.
- (b) Discuss in detail **two** reasons why provision for lifetime use should be considered at the design stage of a dwelling.

3. The drawing shows the elevation, the ground floor plan and portion of the rear garden of a two-storey semi-detached house with an adjoining flat roofed storeroom. The storeroom wall A-A is south facing. The external walls are 350 mm concrete block walls with a full-fill insulated cavity. Planning permission is being sought to convert the storeroom to an attractive space suitable for use as a study.



- (a) Discuss in detail **three** functional requirements of a space suitable for use as a study.
- (b) Using notes and freehand sketches, show a proposed design layout for the study incorporating **each** functional requirement you have specified.
- (c) Using notes and freehand sketches, show a revised external design for the study that will enhance its visual appearance.



4. A house in the vernacular tradition, as shown in the sketch, was built over 100 years ago without insulation and is now in need of significant refurbishment. The occupants have decided to refurbish the house on a step-by-step basis over a number of years.

(a) Discuss **two** advantages and **two** disadvantages of adopting a step-by-step approach to the refurbishment of the house.

(b) A survey of the house reveals:

- external random rubble stone walls, 450 mm in thickness, with an internal and external lime render
- traditional cut roof with natural slates
- suspended timber ground floor.

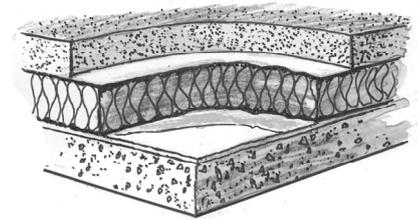


Select any **two** of the above areas and, using notes and freehand sketches, describe the steps involved in upgrading **each** area selected.

Show how the refurbishment should be carried out in a manner that respects the character of the original house and ensures the reuse of materials.

5 (a) Using the following data, calculate the U-value of the insulated concrete ground floor:

Concrete floor slab	thickness	125 mm
Extruded polystyrene insulation	thickness	200 mm
Damp proof membrane (DPM)	thickness	0.30 mm
Sand blinding	thickness	30 mm
Hardcore	thickness	225 mm



**Thermal data of floor:**

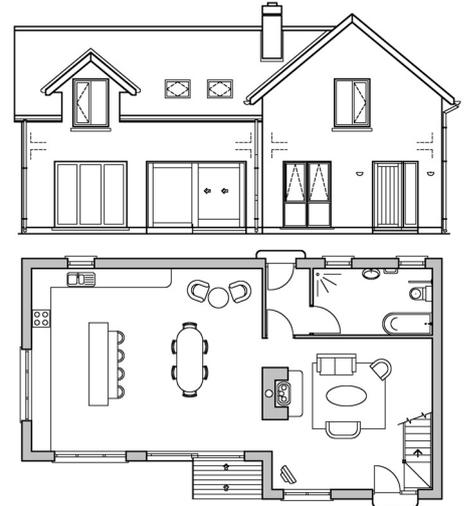
Resistance of top surface of floor	(R)	0.104	m <sup>2</sup>	°C/W
Conductivity of concrete	(k)	0.160	W/m	°C
Conductivity of polystyrene insulation	(k)	0.031	W/m	°C
Conductivity of damp proof membrane (DPM)	(k)	0.450	W/m	°C
Conductivity of sand blinding	(k)	0.160	W/m	°C
Conductivity of hardcore	(k)	1.260	W/m	°C

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

Dimensions of floor	13.0 metres × 7.0 metres
Average internal temperature	21°C
Average external temperature	7°C
Heating period	12 hours per day for 39 weeks per annum
Cost of oil	95 cent per litre
Calorific value of oil	37350 kJ per litre
1000 Watts	1 kJ per second

(c) A solid concrete ground floor abuts a 350 mm concrete block external wall with an insulated cavity. Using notes and freehand sketches, show best practice design detailing which will prevent the formation of a cold bridge at the junction of the floor and the wall. Show the typical design detailing from the bottom of the hardcore to the top of the skirting board.

6. The elevation and the ground floor plan of a house are shown. The house has three bedrooms and a bathroom upstairs. The external walls are of timber frame construction with a rendered concrete block outer leaf. The house is designed to have low environmental impact.



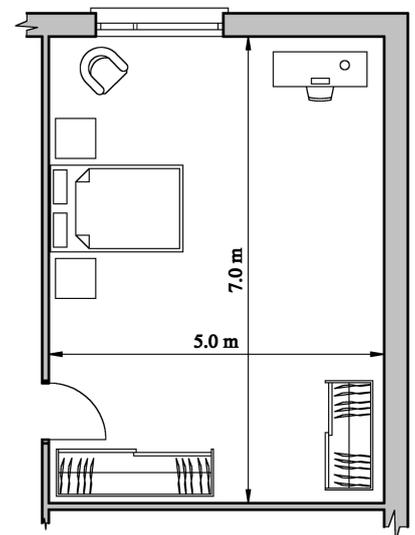
- (a) With reference to the design shown, discuss in detail, using notes and freehand sketches, **three** features of the design that contribute to the house having low environmental impact.
- (b) Describe, using notes and freehand sketches, **two** other design features that could be introduced to further reduce the environmental impact of the house. Justify your choice of design features.
- (c) Discuss the importance of designing low environmental impact housing.

7. The sketch shows a wooden casement window fitted in the external wall of a dwelling house. The window, which is 800 mm in height, is a triple glazed, high performance window with a thermally broken insulated frame. The external wall is a 400 mm concrete block wall with a 200 mm full-fill insulated cavity. The wall has an external render and an internal hardwall plaster skim finish.



- (a) To a scale of 1:5, draw a vertical section through the wall and the centre of the window. The section should show the typical construction details from 300 mm below the window cill, through the fixed frame of the window, to a level 450 mm above the window head. Include **three** typical dimensions on your drawing.
- (b) Indicate clearly on your drawing the typical design detailing to prevent the ingress of water at **both** the window head and cill.
8. It is proposed to redesign the existing bedroom shown in the drawing to accommodate a small en-suite bathroom. The bedroom is located on the first floor of the dwelling house.

- (a) Draw a freehand sketch of the bedroom shown and indicate a preferred location for the bathroom in the bedroom. Show the location of the following: *door, window, shower, wash hand basin and W.C.* Justify your design choices.
- (b) Using notes and freehand sketches, show the above-ground pipework necessary for the safe removal of waste from the shower, wash hand basin and W.C. Include on your sketch typical sizes of the soil and vent pipe (*svp*) **and** of the waste pipe from each fitting.
- (c) Outline **two** design considerations to ensure the economical use of water in the bathroom.

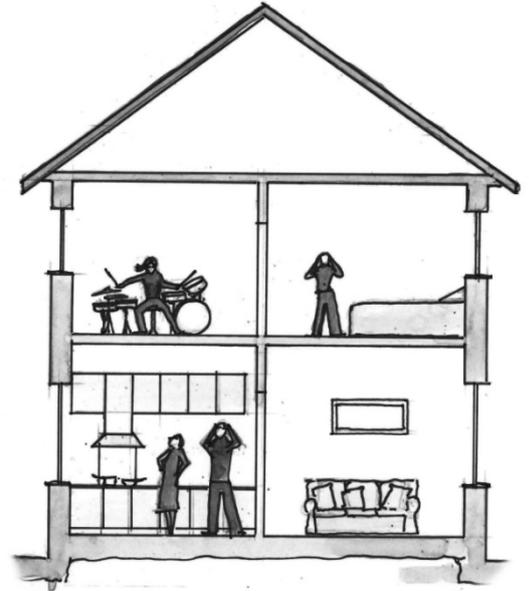


9. (a) Using notes and freehand sketches explain any **two** of the following:

- sound absorption
- sound reflection
- reverberation time.

(b) A bedroom is located on the first floor of a house, directly above the kitchen, as shown in the sketch. Music from the bedroom can be heard in the adjoining rooms and in the kitchen beneath. The bedroom has a standard stud partition and a softwood floor on wooden joists, with a plasterboard ceiling beneath. It has been decided to upgrade the existing partition and floor to reduce the transmittance of sound from the bedroom.

Using notes and freehand sketches, show a revised design detailing that will reduce the transmittance of sound through the floor **and** the existing stud partition. Specify the materials to be used and give their typical dimensions.

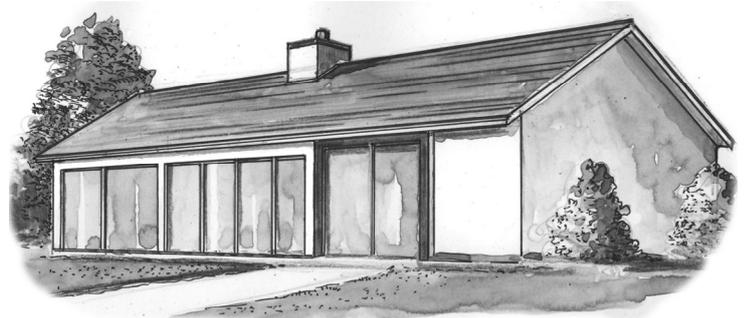


(c) Explain the sound insulation principles associated with the design details you have shown.

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:

- building form
- indoor air quality
- foundation design.

(b) Using notes and freehand sketches, discuss the importance of orientation in the siting of a Passive House. Show the sun path in your sketch.



(c) A Passive House, as shown in the sketch, may overheat in summer. Discuss **two** reasons why overheating occurs and, using notes and freehand sketches, show **two** design details that would reduce the possibility of overheating.

**OR**

10. “Our common ground starts with the planet. As a species we have never been more vulnerable than we are today. The world is under stress and we are the cause of it. We are now at a tipping point and, as with all periods of great change, there is great opportunity. The world needs the way architects think, we should not keep ourselves aloof from the urgent situation we are in. The most resilient and sustainable form of human habitation is the town or the neighbourhood. We must build to create neighbourhoods. We must plan and design to avoid isolation and disconnection. We must design for what matters, which is ultimately happiness.”

Adapted from: PRESIDENT’S INTRODUCTION - Michelle Fagan, President RIAI  
IRISH ARCHITECTURE, Vol. 3, 2012 / 2013. RIAI, 8 Merrion Square, Dublin 2. ISBN: 978-0-9567493-2-1

Discuss the above statement in detail and propose **three** planning guidelines that would promote the development of resilient and sustainable neighbourhoods in Ireland.

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