



Leaving Certificate Examination, 2011

Construction Studies

Theory - Higher Level

(300 marks)

Wednesday, 22 June
Afternoon, 2:00 to 5:00

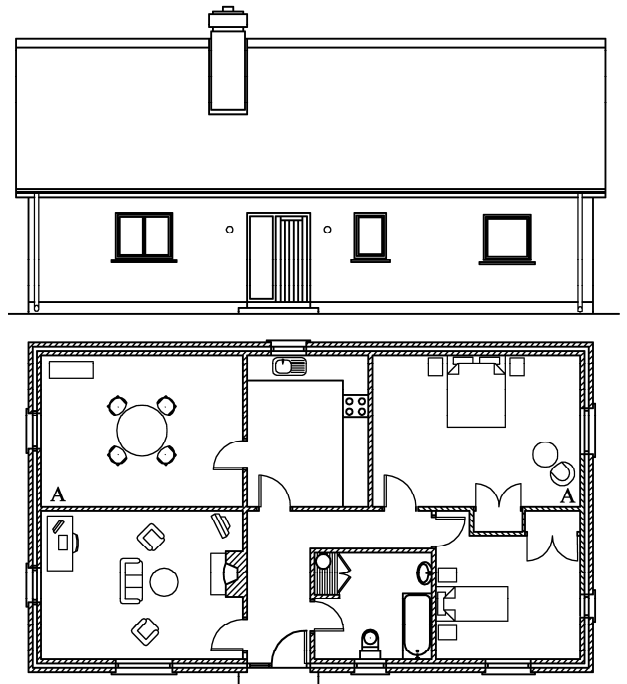
- (a) Answer **Question 1** and **four** other questions.*
- (b) All questions carry equal marks.*
- (c) Answers must be written in ink.*
- (d) Drawings and sketches to be made in pencil.*
- (e) Write the number of the question distinctly before each answer.*
- (f) Neat freehand sketches to illustrate 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 main external doorway of a dwelling house is designed to facilitate access for everyone, including a person with reduced mobility, as shown in the sketch.
The door is a framed wooden door with 12 mm thick vertical sheeting on both sides. The doorframe is 150 mm × 70 mm and is fixed in a 350 mm external concrete block wall with an insulated cavity.
The house has an insulated solid concrete ground floor with a 20 mm quarry tile finish.



- (a) To a scale of 1:10, draw a vertical section through the centre of the door. The section should show the typical construction details from 500 mm below finished floor level, through the threshold, the door, the doorframe and the external wall to a level 300 mm above the concrete lintels over the doorframe.
- (b) Show on the drawing the design detailing that ensures that rainwater is removed from the threshold area.
2. (a) Discuss in detail, using notes and freehand sketches, **three** functional requirements of a roof suitable for a dwelling house.
- (b) Using notes and freehand sketches, show **two** different types of pitched roof structure suitable for a dwelling house having an internal span of 6.0 metres and one internal load-bearing wall.
For **each** roof type, indicate the design detailing that ensures the structural stability of the roof and include the typical dimensions of **three** structural members.
- (c) Recommend a preferred roof structure for a dwelling house and give **two** reasons in support of your recommendation.

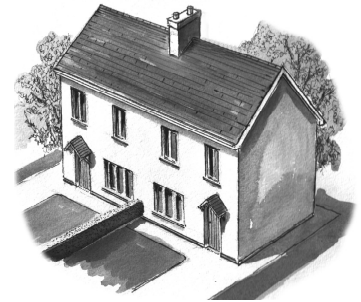
3. The plan and elevation of a house built thirty years ago are shown in the accompanying drawing.
The house is of traditional construction with a slated cut roof and a 300 mm external cavity wall of concrete block construction. The internal walls are of 100 mm solid block construction and the internal wall A-A is a load bearing wall.
The front elevation is south facing.
It has been decided to renovate the house to improve its thermal performance by:



- redesigning the external envelope to allow the increased penetration of sunlight into the interior of the house
 - and**
 - redesigning the layout of the interior to optimise solar gain.
- (a) For **each** of the above, show using notes and freehand sketches, a revised design detailing that will improve the thermal performance of the dwelling house.
- (b) For **each** of the above, discuss in detail the reasons for your proposed design choices when redesigning the house shown.

4. (a) Discuss in detail, using notes and freehand sketches, the importance of **each** of the following in reducing the transmittance of sound in a dwelling house:
- mass
 - completeness
 - isolation.

- (b) The party wall between the two semi-detached houses shown in the sketch is of concrete block construction. The occupants of one house can hear everyday sounds from the adjoining house. Discuss **two** possible reasons why sound is transmitted between the houses, and using notes and freehand sketches, show the revised design detailing that would improve the sound insulation properties of the party wall between both houses.

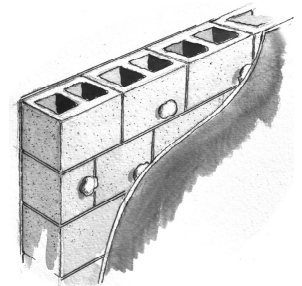


- (c) To reduce the transmittance of sound through a timber stud partition between two adjoining bedrooms on the first floor in one of the houses, it has been decided to redesign the partition. Show, using notes and freehand sketches, a revised design for the stud partition and outline the sound insulation principles associated with each design detail. Specify the materials used and give their typical dimensions.

5. The external wall of a house built in the 1970s is constructed using a single leaf 215 mm hollow concrete block. The wall is rendered externally and plasterboard is fixed to the internal surface using dabs of plaster adhesive, as shown in the accompanying sketch.

- (a) Calculate the U-value of the external hollow block wall, given the following data:

External render	thickness	15 mm
Concrete hollow block	thickness	215 mm
Air space between plasterboard and block	width	10 mm
Internal plasterboard	thickness	12 mm



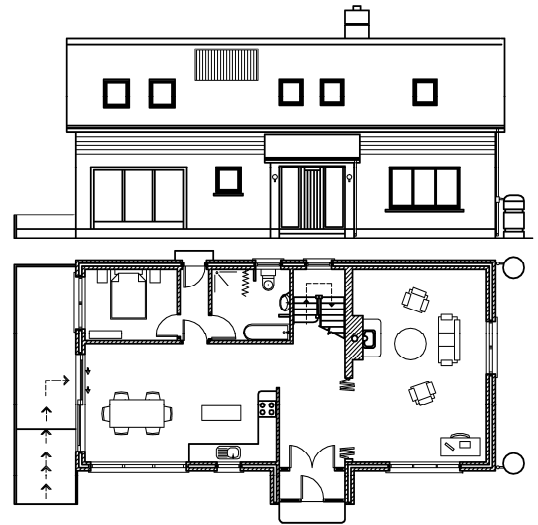
Thermal data of external wall of house:

Resistance of external surface	(R)	0.048	m ²	°C/W
Resistivity of external render	(r)	2.170	m	°C/W
Resistance of hollow block	(R)	0.210	m ²	°C/W
Resistance of airspace	(R)	0.170	m ²	°C/W
Conductivity of plasterboard	(k)	0.160	W/m	°C
Resistance of internal surface	(R)	0.104	m ²	°C/W

- (b) It is proposed to upgrade the thermal properties of the wall by fixing expanded polystyrene to the external surface. 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 0.27 W/m² °C to meet the requirements of the current Building Regulations.
- (c) In the past, many dwelling houses were built using hollow concrete blocks, as outlined at 5 (a) above. Discuss **two** disadvantages of this type of construction, and using notes and freehand sketches, recommend a preferred external wall type suitable for a contemporary house.

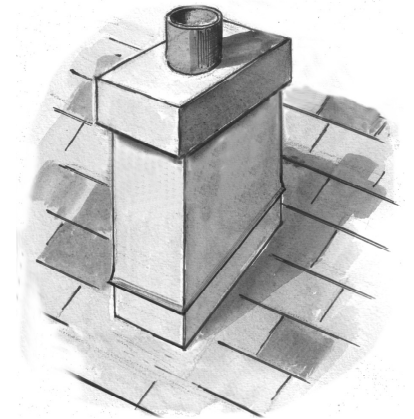
6. The elevation and ground floor plan of a house are shown. The house has two additional bedrooms and a bathroom upstairs. The external leaf is of concrete block and cedar cladding construction, as shown. The house is designed to have low environmental impact.

- (a) With reference to the design shown, discuss in detail, using notes and freehand sketches, **three** features of the design that ensure the house has low environmental impact.
- (b) Discuss in detail the importance of **each** of the following when designing environmentally sustainable housing:
- form of the house
 - materials and labour
 - design for lifetime use.

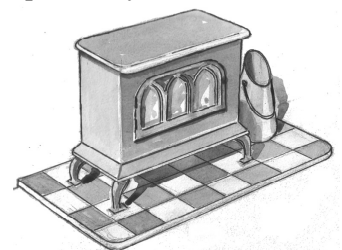


7. A concrete block chimney stack with a sand/cement render passes through a cut roof which is slated and is pitched at 45°, as shown in the sketch.

- (a) To a scale of 1:5, draw a vertical section through the chimney stack and roof, showing the typical details of the chimney stack, flue, chimney capping and portion of the roof structure. Show clearly the design details necessary to prevent the penetration of water between the chimney stack and the adjoining roof surface.
- (b) On your drawing, show **two** design details that will help prevent the occurrence of a downdraught in a chimney as shown. Include dimensions as appropriate.

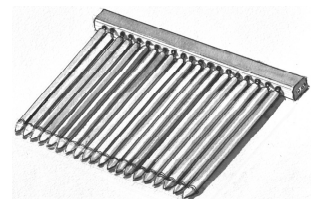


8. (a) A wood burning stove, as shown in the sketch, is used to heat two independently controlled heating zones, one on each floor, in a two storey dwelling house. Using notes and a single-line diagram, show a typical design layout for the pipework necessary to independently heat each zone. Show **three** radiators on each floor, indicate the control valves and give the typical sizes of the pipework.



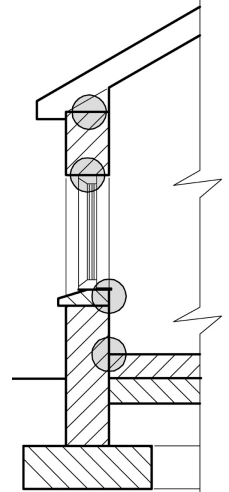
- (b) It is proposed to connect a solar collector, as shown in the sketch below, to the system at **8(a)** above to heat domestic water. Show a design layout for the pipework necessary to connect the solar collector to the existing system and outline the modifications required to the existing system to accommodate the solar collector.

- (c) Using notes and freehand sketches, show a preferred location for the solar collector and discuss in detail **two** factors that influenced your choice of location.



9. Careful design detailing is necessary in order to design a building envelope which is free of thermal/cold bridges. The drawing shows an outline section through a single storey house having a 350 mm external concrete block wall with an insulated cavity. The ground floor is an insulated solid concrete floor.

- (a) Select any **three** locations from those circled on the sketch, and show clearly, using notes and annotated freehand sketches, the typical design detailing which will prevent the formation of thermal bridges at each location selected.
- (b) Discuss in detail **two** advantages of designing a building envelope which is free of thermal bridges.

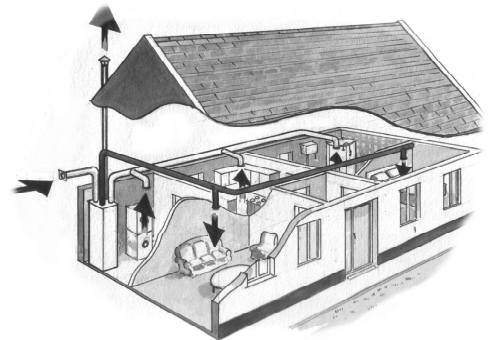


10. (a) Using notes and freehand sketches, discuss in detail the importance of any **two** of the following in the design of a Passive House:

- foundations suitable for a Passive House
- airtight building envelope
- windows and glazing.

- (b) A Mechanical Heat Recovery with Ventilation (MHRV) system for a Passive House is shown in the accompanying sketch. Using notes and freehand sketches, describe how such a system operates.

- (c) Discuss in detail **two** advantages and **two** disadvantages of using a Mechanical Heat Recovery with Ventilation system in a domestic dwelling.



OR

10. “A good neighbourhood is one where people can easily satisfy daily needs whilst feeling safe to do so. The most successful neighbourhoods are well connected – to employment centres, or places where people spend their leisure time. They are places where people can live at any stage of their lives – regardless of physical ability or social status. Successful neighbourhoods also tend to have a wide variety of things to do within them and have a strong connection to the area in which they sit – be it historical, cultural or visual.”

Urban Design Manual – A Best Practice Guide (2009).
Department of the Environment, Heritage and Local Government..

Discuss the above statement in detail and propose **three** guidelines for best practice that would help create sustainable urban neighbourhoods.

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