



Pre-Leaving Certificate Examination, 2016

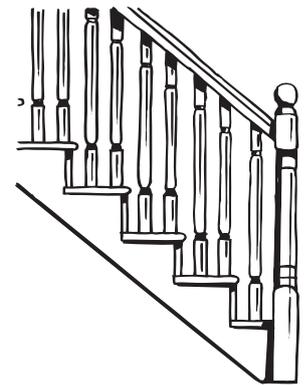
Construction Studies
Theory - Higher Level

(300 marks)

Time: 3 Hours

- (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 bottom portion of a cut-string stairs suitable for a dwelling is shown. The newel post is 100 mm × 100 mm and the rise and going complies with current Building Regulations.
- (a) To a scale of 1:5, draw a vertical section through the centre of the stairs. The section should show the typical construction details through the bottom three steps of the stairs, showing the newel post, balusters and handrail to the stairs. Include the typical dimensions of **three** structural members of the stairs.
- (b) Indicate on your drawing **two** design features that ensure that the stairs is safe for all users.

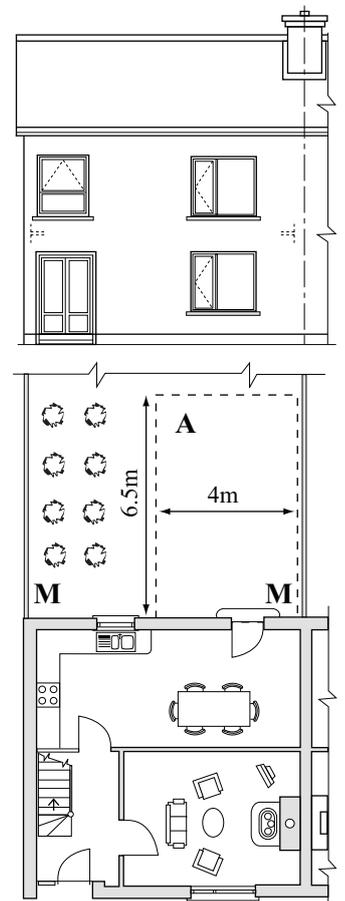


2. (a) Using notes and freehand sketches, discuss **three** functional requirements of a foundation suitable for a dwelling house.
- (b) Show, using notes and freehand sketches, the typical design detailing of **three** different foundation types suitable for a dwelling house. For **each** foundation type, specify the most appropriate ground conditions.
- (c) Discuss **two** factors that must be taken into account to ensure the maximum strength of concrete in a foundation.

3. The drawing shows the elevation, ground floor plan and a portion of the rear garden of a two-storey semi-detached house. The external walls of the house are 350 mm concrete block walls with an insulated cavity. The rear wall **M-M** of the house is south facing.

Planning permission is being sought to build a single-storey extension at **A** to the rear of the house to increase the living space and to provide a bathroom suitable for a person with reduced mobility. The space is to have internal dimensions of 4.0 metres by 6.5 metres as shown. The owners also wish to increase the thermal performance of the dwelling.

- (a) Using notes and freehand sketches, show a proposed external design and internal layout for the bathroom and additional living space. Show in your design how the proposed space will contribute to the thermal performance of the building.
- (b) With reference to the thermal performance of the building, discuss in detail the reasons for your proposed design choices.
- (c) Using notes and freehand sketches, outline one test that may be carried out on an underground drainage system to determine if the pipework is watertight.



4. A terrace of two-storey townhouses, as shown in the drawing, was built over 100 years ago. One of the houses is in need of immediate repair.

- (a) A survey of the house reveals:
- traditional cut roof with natural slates
 - single-glazed, softwood, sliding sash windows
 - external random rubble stone walls, 450 mm in thickness, with an external lime render

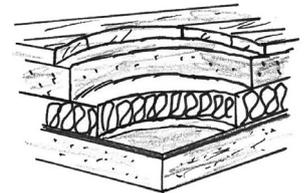


Select any **two** of the above areas and, using notes and freehand sketches, describe the steps involved in upgrading **each** area selected. Show how the repairs should be carried out in a manner that respects the character and appearance of the original terraces.

- (b) Discuss the importance of any **two** of the following when carrying out renovations of an old house built in the vernacular tradition:
- craftsmanship
 - compliance with modern building standards
 - choice of materials.

5. (a) Using the following data, calculate the U-value of the insulated solid concrete ground floor with a hardwood finish of a dwelling house.

Hardwood timber floor	thickness	25 mm
Concrete floor slab	thickness	150 mm
Extruded polystyrene insulation	thickness	50 mm
Damp proof membrane (DPM)	thickness	0.25 mm
Sand blinding	thickness	40 mm
Hardcore	thickness	225 mm



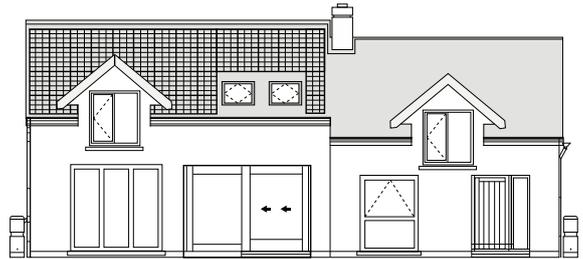
Thermal data of floor:

Resistance of internal surface	(R)	0.104	m ²	°C/W
Conductivity of hardwood floor	(k)	0.180	W/m	°C
Conductivity of concrete	(k)	0.160	W/m	°C
Conductivity of polystyrene insulation	(k)	0.025	W/m	°C
Conductivity of damp proof membrane (DPM)	(k)	0.350	W/m	°C
Conductivity of sand blinding	(k)	0.160	W/m	°C
Conductivity of hardcore	(k)	1.300	W/m	°C

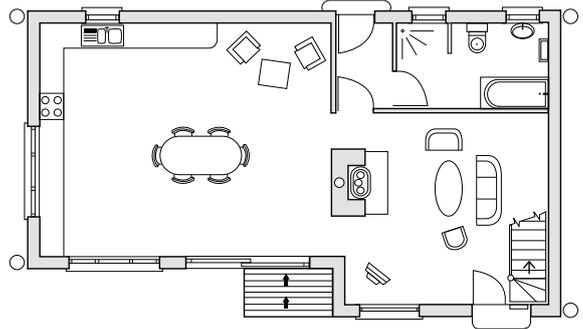
- (b) Following a review of the thermal performance of the house specified above, it has been proposed to upgrade the thermal properties of the floor by fixing additional polystyrene to the floor. Calculate the thickness of expanded polystyrene required to achieve a U-value of 0.21 W/m² °C.
- (c) Using notes and freehand sketches, show best practice design detailing to prevent the ingress of radon gas at the junction of the wall and floor of the house specified above.

6. The elevation and 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 a low environmental impact and be suitable for lifetime use.

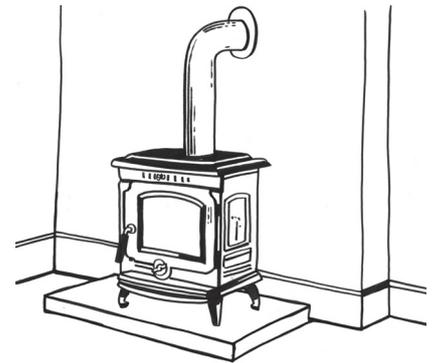
- (a) Using notes and freehand sketches, discuss the importance of **two** of the following in designing a house suitable for lifetime use:
- choice of materials
 - proximity to services
 - easy to modify.



- (b) Using notes and freehand sketches, discuss **three** features of the design that ensure that the house has low environmental impact.
- (c) Discuss **two** advantages of designing a house to have a low environmental impact.



7. A modern wood-burning stove is located in the living room of a single-storey dwelling as shown in the accompanying drawing. The chimney is located on an internal 215 mm solid concrete block wall. The flue from the stove to the main flue liner is 150 mm in diameter. The floor is an insulated solid concrete ground floor with a 20 mm quarry tile finish. The dimensions of the stove are: height 660 mm, width 535 mm, depth 400 mm.

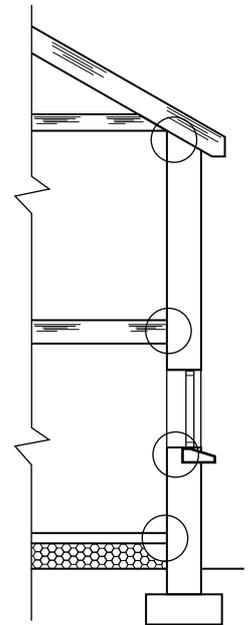


- (a) To a scale of 1:5, draw a vertical section through the ground floor, hearth and chimney. Show the typical construction details from the bottom of the foundation to a level 300 mm above the top of the flue from the stove, and include the connection to the main flue liner in the chimney. Include **three** typical dimensions on your drawing.
- (b) Indicate clearly on your drawing how the flue liners in the chimney are joined to ensure the safe removal of smoke and flue gases.

8. (a) Using notes and freehand sketches, show the correct electrical wiring layout for **two** lights and **two** switches in a radial circuit for a domestic electrical installation. Indicate on your sketch the sizes and colour coding of all electrical cables used in the circuit.
- (b) Using notes and freehand sketches, show **two** safety features in the design of the above circuit to ensure that the circuit is safe for all users.
- (c) Outline **two** design strategies to ensure the economical use of electricity in the home.

9. A two-storey house, as shown in the drawing, is of a timber frame construction with a rendered concrete block outer leaf. The ground floor is an insulated solid concrete floor. Careful design detailing is required to prevent air leakage at the critical junctions circled in the drawing.

- (a) Select any **three** locations from those circled on the drawing and, using notes and freehand sketches, show best practice design detailing that will prevent air leakage at **each** location selected.
- (b) Discuss the importance of controlled ventilation when designing a building.
- (c) Using notes and freehand sketches, show the design detailing to prevent the spread of fire through the cavity of a timber frame building at the window opening.



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
- thermal mass
- energy performance.

(b) The accompanying drawing shows a house with a fully glazed facade. Using notes and freehand sketches, discuss **two** design considerations that should be taken into account when deciding on the glazing system for the Passive House shown.



(c) Discuss in detail **two** advantages and **two** disadvantages of Passive House construction.

OR

10. The old adage - saving energy is cheaper than buying it - certainly rings true in the current economic situation. Approximately 25% of Irish carbon dioxide (CO₂) emissions come from residential energy use. Transforming the energy performance of Ireland's building stock is a huge challenge but one that can provide much needed stimulus to the construction sector. Policy makers and legislators have recognised that we cannot meet environmental targets without reducing the environmental impact of buildings and infrastructure. In short we have to change the way we design and build.

*Adapted from ENVIRONMENTAL CHALLENGES AND OPPORTUNITIES FOR THE CONSTRUCTION SECTOR IN IRELAND (2011).
Published by Enterprise Ireland, The Plaza, East Point Business Park, Dublin 3.*

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

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