Pre-Leaving Certificate Examination, 2015

Construction Studies

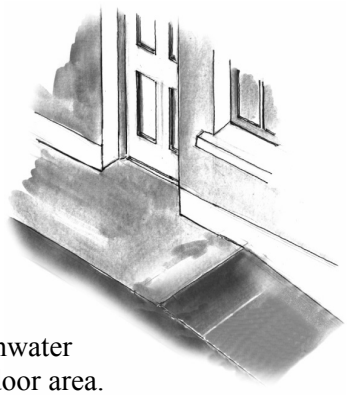
Theory - Higher Level

(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.*

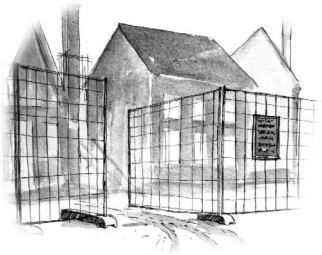
1. The sketch shows a hardwood front door of a dwelling house. The door frame is 150 mm × 70 mm and is fitted into a 350 mm external block wall with an insulated cavity. The house has a solid concrete ground floor.



(a) To a scale of 1:5, draw a vertical section through the door showing the threshold, door and doorframe and head detail. The section should show the typical construction details from 500 mm below the bottom of the door and 300 mm above the head of the door.

(b) Indicate clearly on your drawing the design detailing to ensure that rainwater is removed from the threshold area and does not penetrate around the door area.

2. Health and safety regulations provide protection to all construction personnel to ensure a safe working environment.



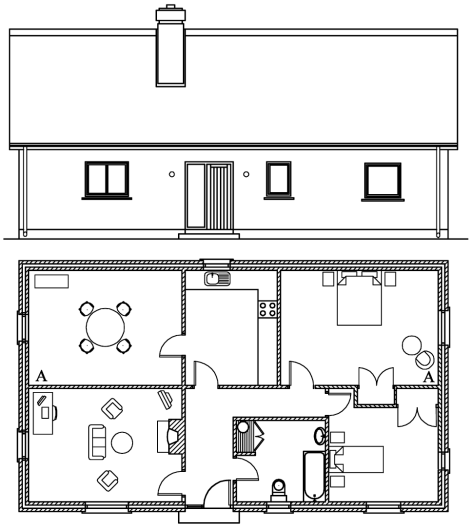
(a) Identify **two** possible risks to personal safety associated with **each** of the following:

- fitting a concrete cill on the second story of a dwelling house
- slating a steeply pitched roof
- working with electrical tools on a building site.

(b) Using notes and freehand sketches as appropriate, outline **two** specific safety procedures that should be observed to eliminate **each** risk identified at **2(a)** above.

(c) Discuss **two** reasons why younger workers are more vulnerable to accidents on construction sites and suggest **three** strategies to encourage a safety culture in younger workers.

3. The plan and elevation of a house built over 30 years ago is shown in the accompanying drawing. The front elevation is south facing. The external walls are 300 mm cavity construction. The internal walls are 100 mm solid block construction and the internal wall **A-A** is load bearing. The owner has decided to renovate the house to improve the thermal performance by redesigning:



- the external envelope, to allow for increased penetration of sunlight into the house
- the interior, to take full advantage of the increased sunlight in the house.

(a) For **each** of the above show, using notes and freehand sketches, the revised design detailing that will improve the thermal performance of the dwelling house.

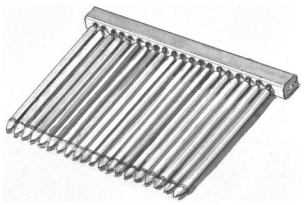
(b) Using notes and freehand sketches, show an alternative design layout for the kitchen, which would make it suitable for a person in a wheelchair. Include all necessary appliances in the sketch.

4. A wood burning stove is used as the heat source to provide hot water and central heating in a two-storey house. The system has two independently controlled heating zones.

(a) Using a single line diagram, show a design layout for the pipe work required to provide heating and hot water in the dwelling. Include **three** radiators on the ground floor and **three** radiators on the first floor.

(b) Indicate on the drawing **three** necessary valves to ensure safe running of the system and write a short note explaining their function.

(c) A solar collector as shown in the sketch is to be incorporated into the existing heating system. Using notes and neat freehand sketches, show the design layout necessary to connect the solar panel to the existing system.



5. A house built over thirty years ago has an un-insulated external cavity wall. The external surface of the wall is completed with cement rendering and plaster finish on the internal surfaces.

External render	thickness	19 mm
Concrete block outer leaf	thickness	100 mm
Un-insulated cavity	width	100 mm
Concrete block inner leaf	thickness	100 mm
Internal plaster	thickness	16 mm

Thermal data of external wall:

Resistance of external surface	(R)	0.550	m^2	°C/W
Resistivity of external cement rendering	(r)	2.170	W/m	°C
Conductivity of concrete block outer leaf	(k)	1.440	W/m	°C
Resistance of cavity	(R)	0.170	m^2	°C/W
Conductivity of concrete block inner leaf	(k)	1.440	W/m	°C
Resistivity of internal plaster	(r)	2.170	W/m	°C
Resistance of internal surface	(R)	0.122	m^2	°C/W

(a) Calculate the U-value of the external wall.

(b) Using the thermal data below and the U-value obtained in **5(a)** above, calculate the annual cost of heat loss through the wall of the dwelling.

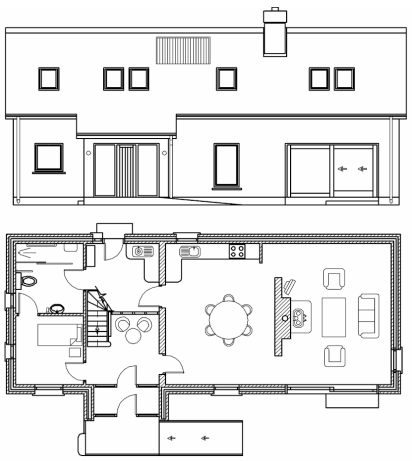
Thermal data of external wall:

Area of the external wall	150 m^2
Average internal temperature	21°C
Average external temperature	6°C
Heating period	10 hours a day for 38 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) Using notes and freehand sketches, show how the thermal properties of the wall can be increased.

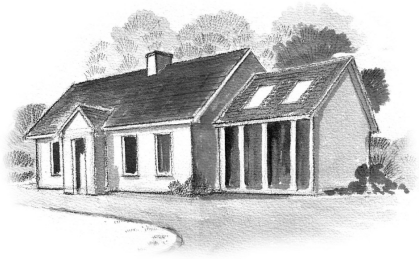
6. **(a)** Discuss in detail the importance of **each** of the following when designing an environmentally sustainable dwelling house:

- location of the house in the landscape
- form of the house
- materials and labour.



(b) The accompanying drawing shows the elevation and plan of a house to be built in a rural area.
The house is designed to have low environmental impact.
Using notes and freehand sketches, outline **three** features in the design that contribute to reducing the environmental impact of the house.

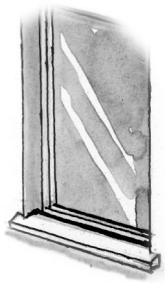
7. A new extension has been constructed to a dormer bungalow to provide space for a new kitchen area as shown in the sketch.
The new extension has a solid concrete floor with a tiled finish.
The existing bungalow was constructed with a 350 mm insulated cavity wall and has a suspended timber floor.



(a) To a scale of 1:5, draw a vertical section through the party wall showing the construction details of the **two** floors.
Both floors are finished at the same level. Include **four** typical dimensions on your drawing.

(b) Show clearly on the drawing a method of providing cross-ventilation between the **two** floors.

8. **(a)** The owner of an office wishes to increase the amount of natural light entering the work space by increasing the size of an existing window.
Determine by the degree of efficiency method or any other method the approximate area of the new window to increase the average daylight to 200 lux. Assume an unobstructed view and the illumination of a standard overcast sky to be 5000 lux. The floor size of the office is 4 m long by 3.8 m wide.

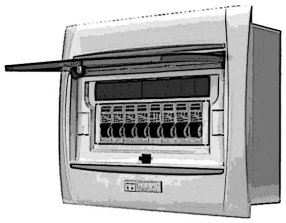


(b) Show, using notes and freehand sketches, the correct design detailing that will prevent the formation of thermal bridges and air leakage, at the following locations:

- window head
- window cill.

(c) Show, using notes and freehand sketches, how the window may be securely fixed in an external wall.

9. Proper installation of electrical circuits in the home is critical to the safety of all homeowners.

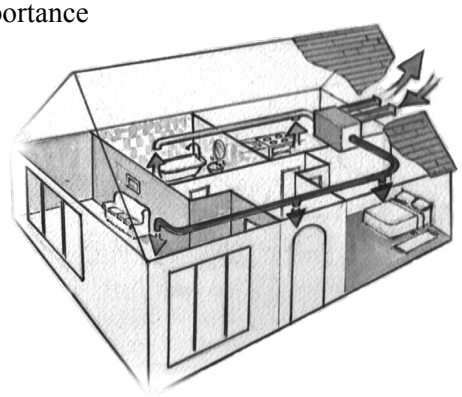


(a) Using notes and freehand sketches, show the main considerations to be taken into account when designing and installing electrical circuits in the kitchen and bathroom of a dwelling house.

(b) Show, using notes and freehand sketches, the correct wiring for **two** lights and **two** switches in a radial circuit of a dwelling house. Indicate on the sketch the sizes and colour coding of the electric cables.

(c) Using notes and freehand sketches, show **three** features in the design that will ensure economical use of electricity.

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



- insulated building envelope
- controlled air changes
- windows and glazing.

(b) Explain, using notes and freehand sketches, how a Mechanical Heat Recovery with Ventilation (MHRV) system operates for a Passive House.

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

OR

10. ‘‘The suburban spread of settlements over the last decade could be viewed as having been wasteful both in terms of its impact on the existing fabric of existing towns and in terms of the continual erosion of the landscape. If this trend is reversed, the built fabric of towns and villages will need to be reviewed, and dwellings and related facilities provided which will attract families back to them.’’

Developing a Government Policy on Architecture (2006)

Discuss the above statement in detail and propose **three** guidelines that would encourage the regeneration of urban areas.

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