



Pre-Leaving Certificate Examination, 2012

Construction Studies

Theory - Higher Level

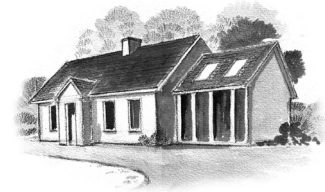
(300 marks)

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. A new extension has been added to an existing dwelling as shown in the accompanying sketch. The external wall is a 350 mm concrete block wall with a 150 mm cavity. The cavity is fitted with rigid insulation board. The suspended timber floor is insulated and has a 25 mm tongued and grooved hardwood finish.

- (a) To a scale of 1:5, draw a vertical section through the external wall and suspended timber floor. Show all construction details from the bottom of the foundation to 400 mm above the finished floor level. Include **four** typical dimensions on your drawing.
- (b) Show clearly on the drawing how you would prevent radon gas from entering the building.



2. The owner of a house built in the 1970s has decided to upgrade the thermal properties of the external walls in their dwelling. The existing walls were constructed using 300 mm cavity wall construction with 40 mm expanded polystyrene insulation in the cavity.

- (a) Using notes and freehand sketches, outline **each** of the following methods that might be used to upgrade the thermal performance of the dwelling:

- an external insulation system
- an injection insulation system
- an internal insulation system.

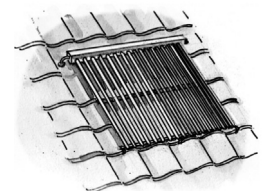
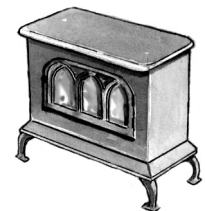
- (b) Outline **two** advantages of each system of insulation and recommend a preferred system to be used.



3. (a) Using notes and a single-line diagram, show a typical design layout of a wood burning stove fired heating system and hot water supply for a two storey house. The system has two independently controlled heating zones. Show **two** radiators on each floor.

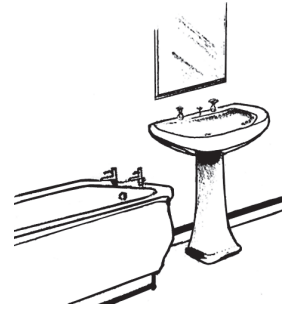
- (b) Indicate on the drawing **three** necessary valves to ensure the safe running of the system and write a short note explaining their function.

- (c) A solar collector as shown in the sketch is to be incorporated into the existing system of providing hot water for domestic use. Show the design layout necessary to connect the solar panel to the existing system.



4. A properly designed and constructed sewerage system is essential for the safe removal of waste from a domestic house in a rural area.

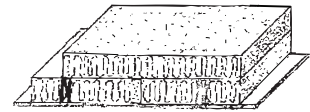
- (a) Discuss in detail **three** risks associated with a poorly designed sewerage system.
- (b) Using notes and freehand sketches, show **three** considerations that should be taken into account when laying sewer pipes to ensure the safe removal of waste from a dwelling.
- (c) The accompanying sketch shows a bathroom on the first floor of a dwelling house. Using notes and neat freehand sketches, show the typical pipe layout of single-stack system to remove waste safely from the bathroom.



5. A house built over twenty years ago has a pitched roof and is insulated with a fibreglass quilt placed between the ceiling joists.

- (a) Calculate the U-value of the roof, given the following data:

Concrete roof tiles	thickness	20 mm
Fibreglass insulation	thickness	150 mm
Plasterboard	thickness	12.7 mm



Thermal data of roof:

Resistance of external surface of tiles	(R)	0.053	m ²	°C/W
Conductivity of tiles	(k)	0.833	W/m	°C
Resistance of internal surface of tiles	(R)	0.123	m ²	°C/W
Conductivity of fibreglass	(k)	0.033	W/m	°C
Conductivity of plasterboard	(k)	0.160	W/m	°C
Resistance of loft space	(R)	0.176	m ²	°C/W

- (b) Using the thermal data below and the U-value obtained at (5a) above, calculate the cost of the heat lost annually through the roof.

Thermal data:

Area of the roof	140 m ²
Average internal temperature	17 °C
Average external temperature	6 °C
Heating period	11 hours per day for 41 weeks per annum
Cost of oil	85 cent per litre
Calorific value of oil	37350 kJ per litre
1000 watts	1 kJ per second

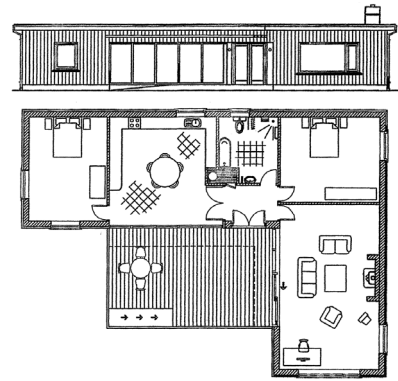
- (c) Using notes and freehand sketches, show the insulation in the attic around the cold water storage tank.

6. (a) Using notes and freehand sketches, discuss in detail **three** planning guidelines that should be observed when designing a new house for a rural area to ensure a low environmental impact.

- (b) The accompanying drawing shows the elevation and plan of the proposed house.

With reference to the design shown, discuss in detail, using notes and freehand sketches, the importance of **each** of the following in ensuring that the house has a low environmental impact:

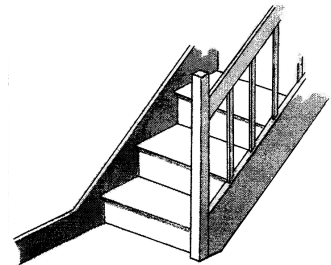
- scale and layout
- selection of materials
- energy requirements.



7. A closed string timber stairs provides access from the ground floor to the first floor in a domestic building.

- (a) To a scale of 1:5, draw a vertical section through the bottom **three** steps of the stairs. Show the newel post, balusters and handrail of the stairs. Show clearly four dimensions of the main structural members of the drawing.

- (b) Using notes and freehand sketches, show **three** design considerations that would ensure that the stairs are safe for all users.

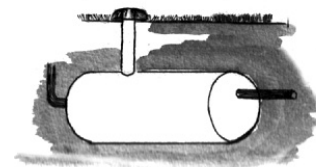


8. The proposed introduction of water charges to homeowners in the near future will encourage the installation of underground storage tanks, as shown, to provide water for domestic use.

- (a) Using notes and a single-line diagram, show the pipework / filters necessary to convey rainwater to the underground tank and back into a separate storage tank in the attic of the house.

- (b) Discuss **two** advantages of using stored rainwater and give **two** suitable uses for this water.

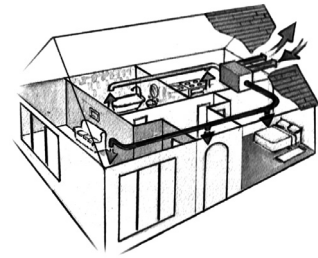
- (c) Recommend **two** other procedures that a homeowner could follow to limit the use of water in the dwelling.



9. Proper installation of electrical circuits in the home is of great importance to the safety of all users.
- (a) Using notes and freehand sketches, show the correct wiring for two sockets in a ring system of a domestic electrical installation.
 - (b) Using notes and freehand sketches, explain the principles of earthing in a domestic electrical installation.
 - (c) Discuss **three** considerations that should be taken into account to ensure safe and economic use of electricity in the home.

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:

- insulated building envelope
- orientation and shade
- shape and form of the building.



- (b) Using notes and freehand sketches, describe how a Mechanical Heat Recovery and Ventilation system (MHRV) operates for a Passive House.
- (c) Overheating in summer can be a problem with Passive Houses. Using notes and freehand sketches, show **two** design details to overcome these problems.

OR

10. “Domestic architecture often combines one or two styles, or is varied or adapted locally depending on the climate, location, materials available, the skills of the builder and workers, economic status, lifestyle, social concerns or restraints and fashions.”

Hearthstones (1993)
Caneta S Hankins

Discuss the above statement in detail and propose **three** guidelines that would help create more environmentally sustainable housing in Ireland.

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