



Leaving Certificate Examination, 2017

Construction Studies

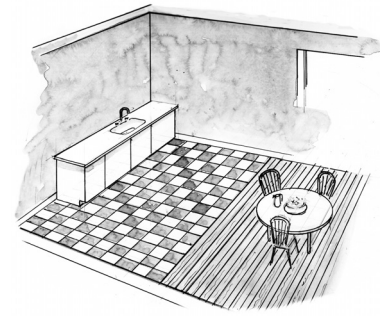
Theory - Higher Level

(300 marks)

Friday, 16 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. A dwelling house has an open-plan kitchen and dining area on the ground floor, as shown. The kitchen has a solid concrete floor with a 20 mm tile finish. The adjoining dining area has a suspended timber floor with a 20 mm tongue and groove hardwood finish on 200 mm × 40 mm joists. Both floors are highly insulated. The external wall of the house is a 400 mm concrete block wall with a full-fill insulated cavity.



- (a) To a scale of 1:10, draw a vertical section through the external wall of the kitchen and through **both** the concrete and timber floors. Show the typical construction details from the bottom of the strip foundation to a level 400 mm above the finished floor and include the abutment of both floors. Show a width of 1.5 metres for each floor.

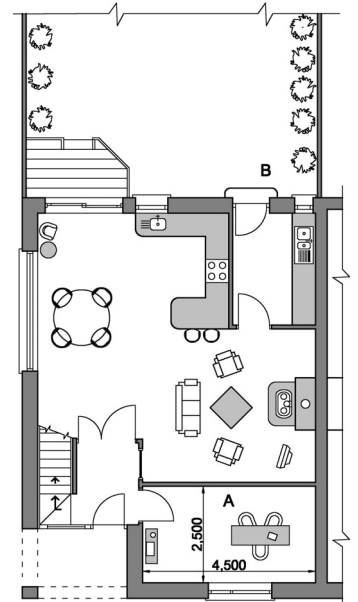
Note: It is not necessary to show the kitchen cabinets or the furniture.

- (b) On your drawing show the typical design detailing for the cross ventilation of the suspended timber floor through the solid concrete floor.

2. (a) Discuss in detail, using notes and freehand sketches, **two** functional requirements of a bathroom designed for lifetime use.

- (b) The drawing shows the ground floor plan of a semi-detached house. The dimensions shown are in millimetres. It is proposed to provide a bathroom suitable for lifetime use by converting the office **A** into a bathroom. Discuss **two** advantages of converting the existing office **A** rather than building a new bathroom at location **B**, as shown.

- (c) Using notes and freehand sketches, show a proposed design layout for the bathroom at **A**. On your design sketches, show the location of the shower area, W.C., wash basin and grab rails. Include appropriate dimensions. On a separate sketch, show **one** design detail that will prevent the penetration of sewer gases into the bathroom at the W.C.



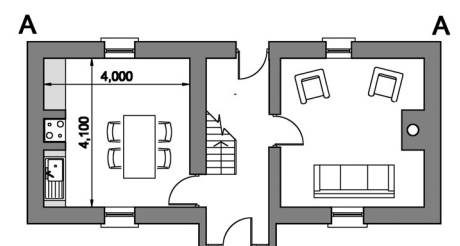
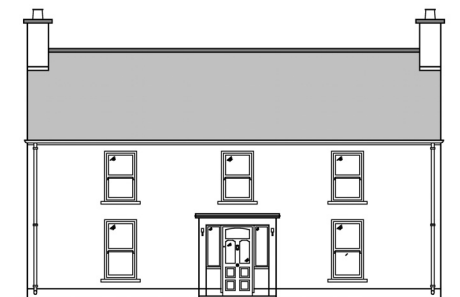
3. The drawing shows the ground floor plan and the front elevation of a farmhouse built in the 1950s. The dimensions shown are in millimetres. The walls are of random rubble construction and are rendered. The rear wall **A-A** is south facing. The owners intend to build a single-storey extension, not greater than 12.0 m² in area, to the rear of the kitchen. Consideration at the design stage is to be given to:

- optimising daylight into **both** the extension and the kitchen
- providing an open-plan kitchen/dining/living space.

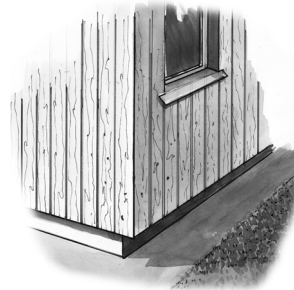
- (a) Using notes and freehand sketches show a proposed design layout that incorporates **each** of the above requirements.

- (b) Discuss **three** reasons for your proposed design layout.

- (c) Discuss **two** advantages of building an extension to the farmhouse shown.



4. (a) Discuss, using notes and freehand sketches, **three** functional requirements of an external wall suitable for a new dwelling house.
- (b) When specifying a high performance **external** wall for a new house, a choice is to be made between:
- a rendered cavity wall of concrete block construction **or**
 - a wall of timber frame construction with a rainscreen of cedar cladding, as shown **or**
 - a rendered wall of timber frame and hemp-lime construction.



Select any **two** of the above wall types, and using notes and freehand sketches, show the typical design detailing for **each** wall type selected.

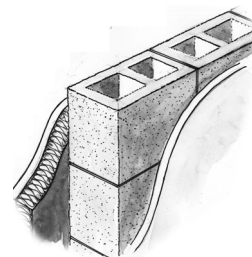
Name the typical components of each wall and include typical dimensions.

- (c) Discuss the construction of **each** wall type selected under the following headings:
- environmental considerations
 - ease of construction.

5. The external wall of a house built in the 1970s is of single-leaf, hollow-block construction with an external render. Plasterboard, with bonded expanded polystyrene, is fixed to the internal surface of the wall, as shown.

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

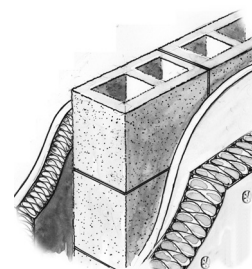
External render	thickness	16 mm
Hollow concrete block	thickness	215 mm
Expanded polystyrene	thickness	25 mm
Plasterboard	thickness	12.5 mm



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 concrete block	(R)	0.210	m ²	°C/W
Conductivity of expanded polystyrene	(k)	0.037	W/m	°C
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 above wall, to meet the Passive House standard, by fixing expanded polystyrene to the external surface, as shown. Using the given thermal data at **5(a)** above, calculate the thickness of expanded polystyrene required to achieve a U-value of 0.15 W/m² °C.

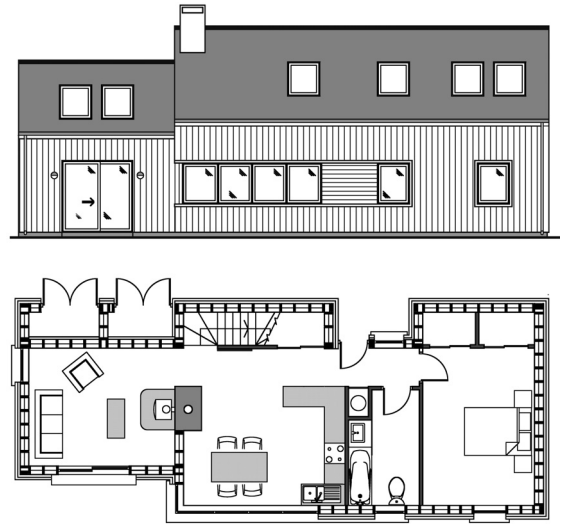


- (c) Calculate the cost of heat lost annually through the upgraded wall at **5(b)** above, using the following data:

Area of external wall	140 m ²
Average internal temperature	18 °C
Average external temperature	6 °C
U-value of wall	0.15 W/m ² °C
Heating period	8 hours per day, every day, for 36 weeks per annum
Cost of oil	98 cent per litre
Calorific value of oil	37350 kJ per litre
1000 Watts	1 kJ per second.

6. The drawing shows a dwelling house, which has two bedrooms and a bathroom upstairs. The house is of timber frame construction with an external rainscreen of native larch. The house is designed to be eco-friendly.

- (a) Discuss in detail **two** advantages of eco-friendly house design in the 21st century.
- (b) Using notes and freehand sketches, discuss in detail **three** features of the given design that contribute to making the house eco-friendly.
- (c) Low operating costs are an important consideration in eco-friendly design. Using notes and freehand sketches, discuss **two** features that could be added to the design that would further reduce the operating costs of the house.



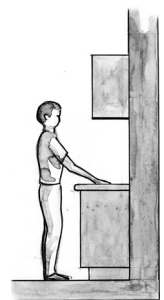
7. The slated roof of a new house is constructed using prefabricated trussed rafters and has a pitch of 45 degrees. The internal span of the house is 4.0 metres. The roof is supported on external walls of timber frame construction, having a rendered concrete block external leaf. Both the roof and the walls are highly insulated.



- (a) To a scale of 1:10, draw a vertical section through the roof structure. Show the typical construction details from a level 400 mm below the ceiling up to ridge level, and include **both** external walls. Show the typical design detailing at **one** of the eaves and include battens, membranes and **four** courses of slate at eaves. Label the components.
- (b) On your drawing show the typical dimensions of **three** roof members.

8. (a) Using notes and freehand sketches, discuss the importance of **each** of the following in providing adequate light on a work surface in a kitchen, as shown:

- natural light
- artificial light.

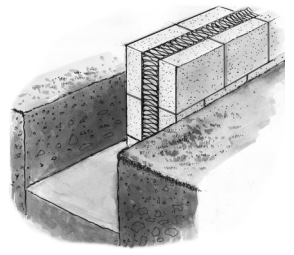


- (b) A home office, as shown, measures 4.8 metres long by 3.5 metres wide. The office has a vertical window and unobstructed views. An average illumination of 500 lux of daylight is required on the work plane. Determine using the degree of efficiency method, or any other suitable method, the approximate area of glazing required to provide the stated illumination. Assume the illumination of a standard overcast sky to be 5000 lux.



- (c) Using notes and freehand sketches, discuss **three** advances in glazing technology that make modern glazing systems more energy efficient.

9. (a) A reinforced concrete strip foundation supports a 400 mm concrete block external wall with an insulated cavity, as shown. Using notes and freehand sketches, show the typical design detailing of the **foundation**. Indicate the position of the reinforcement in the foundation. Specify **three** typical dimensions and discuss the reasons for the dimensions you have specified.
- (b) Using notes and freehand sketches, discuss the importance of **each** of the following to ensure the maximum strength of concrete in the foundation:
- mixing
 - placing
 - compacting
 - curing.
- (c) Using notes and freehand sketches, describe **one** test that may be carried out to measure consistency in the quality of all concrete delivered to a site.

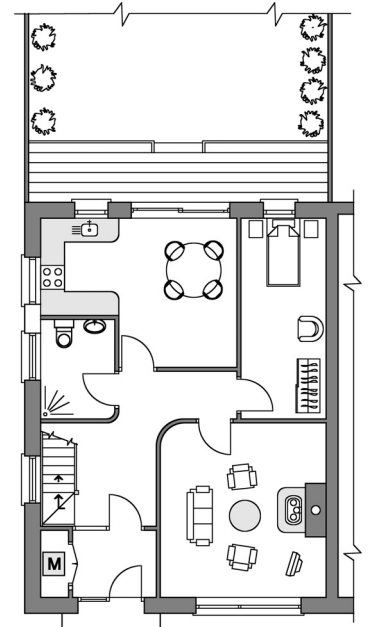


10. (a) Using notes and freehand sketches, discuss the importance of any **two** of the following in Passive House design:
- airtightness
 - indoor air quality
 - solar shading.

- (b) The diagram shows the ground floor plan of a semi-detached house. Also shown is the location **M** in the hallway, of the Mechanical Heat Recovery with Ventilation (MHRV) unit.

Draw a line diagram of the given room layout and show a typical design for the ducting to the MHRV unit. Indicate clearly the direction of the airflow in the ducts and describe how the MHRV system works.

- (c) Discuss **two** advantages of siting the MHRV unit in the hallway, as shown.



OR

10. While there are undoubtedly many buildings whose heritage values dictate that they should be preserved unchanged, the reality is that few are of such importance that they and their settings are not capable of being remodelled to accommodate new uses - especially where they have outlived the functions for which they were constructed, and where adaptation and reuse is the most viable option for extending their lifespans and preserving the vitality of their urban locations. The alternative is to let them fall into disuse and disrepair, along with the ensuing deterioration of their urban environments.

Adapted from: **Use it or Lose it - Challenges in the Protection of Architectural Heritage** – by Paul Keogh.
VOL 6 IRISH ARCHITECTURE - THE RIAI ANNUAL REVIEW 2015/2016. ISBN: 978-0-9567493-5-2
Published by: The Royal Institute of Architects of Ireland, 8 Merrion Square, Dublin 2.

Discuss the above statement in detail and propose **three** best practice guidelines that would promote the adaptation and reuse of heritage buildings built after 1800, to prevent them from falling into disuse and disrepair.

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