AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

LEAVING CERTIFICATE EXAMINATION, 2001

CONSTRUCTION STUDIES - PART I (THEORY)

HIGHER LEVEL

WEDNESDAY, 20 JUNE - AFTERNOON 2.00 p.m. to 5.00 p.m.

(300 marks are allotted to this paper.)

(a) Answer Question 1 and four other questions.
(b) Answer must be written in ink; drawings and sketches to be made in pencil.
(c) Write the number of the question distinctly in the margin of the paper before each answer.
(d) Freehand sketches or diagrams to illustrate written descriptions should be made.
(e) The name, sizes, dimensions and other necessary particulars of each material indicated must be noted on the drawing.
(f) *All questions carry equal marks.*

1. A single-storey dwelling house has a 300mm external concrete block wall with insulated cavity, which includes an opening for a window. The dwelling has a suspended timber floor.
To a scale of 1:5, draw a vertical section through the wall and floor showing all the details from the bottom of the foundation to the top of the concrete cill.

2. Preliminary design sketches of a house show the locations of the main living, dining, sleeping and circulation areas.

(a) Draw a neat single line diagram of the plan of a single storey dwelling showing the location of the entrance, living area, kitchen and dining room, bedrooms, bathroom and other areas. Indicate on the diagram the position of the windows and doors.
Dimensioning of spaces is not necessary.

(b) Explain in detail the design considerations that influence the choice of location of each area indicated on the diagram.

3. Explain in detail, using notes and where necessary sketches, **each** of the following terms as they apply to building technology:

(i) Interstitial Condensation;
(ii) Dew Point;
(iii) Relative Humidity;
(iv) Cavity Insulation;
(v) Cold Bridge;
(vi) Vapour Barrier.

4. (a) To a scale of 1:5, draw a vertical section through the bottom three steps of a closed-string timber stairs suitable for a domestic dwelling.
Show the newel, handrail and balusters.

(b) Indicate, using notes and freehand sketches, **three** design considerations that would ensure that a stairs is safe for all users.

5. (a) Using a neat single line diagrammatic sketch, show the layout of the pipework necessary for the installation of a domestic central heating system to serve at least three radiators.
Show the location of all the necessary valves.

(b) Using notes and sketches, indicate **three** features that could be incorporated into the design of a central heating system for a two-storey house to improve its efficiency and ensure the economical use of fuel.

6. (a) Using notes and sketches, explain the following:
(i) Sound Absorption;
(ii) Sound Reflection;
(iii) Reverberation Time.

(b) An upstairs bedroom equipped with a music system is being renovated.
Using notes and sketches, show **three** design details that would improve the sound insulation properties of this room.

7. In a dwelling house it is proposed to replace the existing 4mm single glazing with double glazed units. The double glazed units consist of two 4mm panes of glass with a 12mm air space.

(a) Using the data given below calculate:

(i) The U value of the single glazing.

(ii) The U value of the double-glazing.

Data:

Thickness of Glass	4mm
Conductivity of Glass	1.02 W/m °C
Resistance of 12mm air space	0.17m² °C/W
Internal surface resistance	0.12m² °C/W
External surface resistance	0.08m² °C/W

(iii) If the dwelling house has $20m^2$ window area and the average air temperature difference across the windows is 8°C, calculate the daily savings in fuel costs resulting from the installation of double glazing, given the following:

Calorific Value of Oil	37350 kj per Litre
Cost of Oil	40p per Litre

(b) Discuss in detail the merits of installing double glazing in a dwelling house.

8. A single-storey traditional dwelling house, over 100 years old, has thick stone walls, a slate roof, wooden doors and windows and solid floors. The house is in need of repair and it has been decided to undertake essential renovations.

(a) Make a checklist of **four** renovations you expect would be needed in a house of this age.

(b) Describe, using notes and sketches, how **each** of these renovations could be carried out in a manner which would respect the age and character of the original house.

9. (a) Using notes and sketches, show the correct wiring for **two** sockets in a ring main circuit of a domestic electrical installation.

(b) Describe, using notes and sketches, the principles of earthing in a domestic electrical installation.

(c) List and explain **three** safety procedures regarding the use of electrical power tools out-of-doors.

10. "Our countryside buildings should not be taken for granted. They deserve far more study and their appropriate use of materials, their sympathy for the landscape and their human scale deserve appreciation, for they are distinctively Irish and a significant part of our architectural and cultural heritage".

Irish Countryside Buildings (1985) *: P & M Shaffrey*.

Discuss.

OR

A listed building of unique architectural importance which was subject to a preservation order, has been demolished. The owner has offered to reconstruct the building as close as possible to the original, using some materials salvaged from the demolition.
What arguments might be presented:
(a) in favour of the reconstruction of the building
(b) in favour of an alternative approach, not involving the reconstruction of the building?

AN ROINN OIDEACHAIS AGUS EOLAÍOCHTA

LEAVING CERTIFICATE EXAMINATION, 2002

CONSTRUCTION STUDIES - PART I (THEORY)

HIGHER LEVEL

WEDNESDAY, 20 JUNE - AFTERNOON 2.00 p.m. to 5.00 p.m.

(300 marks are allotted to this paper.)

(a) Answer Question 1 and four other questions.
(b) Answer must be written in ink; drawings and sketches to be made in pencil.
(c) Write the number of the question distinctly in the margin of the paper before each answer.
(d) Freehand sketches or diagrams to illustrate written descriptions should be made.
(e) The name, sizes, dimensions and other necessary particulars of each material indicated must be noted on the drawing.
(f) *All questions carry equal marks.*

1. An open fireplace in a single storey dwelling is located on a 300mm external concrete block wall with an insulated cavity. The house has a solid concrete floor.

(a) To a scale of 1:5 draw a vertical section through the wall and fireplace. The section should show all the constructional details from bottom of the foundation to the top of the first flue.

(b) Note on the drawing **two** design details that ensure the efficient functioning of the fireplace.

2. Poor design detailing can result in condensation occurring on the inner surfaces of external cavity walls, particularly at (i) wallplate level and (ii) the wall surrounding window and door openings.

(a) Discuss how condensation might occur at locations listed above and using notes and freehand sketches show the correct design details that would prevent the condensation occurring at (i) and (ii) above.

(b) Condensation may also occur on the internal surfaces of the walls of an old house. Discuss **two** possible reasons for its occurrence and using notes and freehand sketches, show **two** means by which its occurrence might be eliminated.

3. (a) Discuss the importance of the use of steel in the manufacture of reinforced concrete, with reference to the:
(i) strength properties of both materials;
(ii) design considerations to avoid deterioration over time.

(b) Describe in detail, using sketches and notes, three methods of combining concrete and steel in the manufacture of concrete lintels.

(c) List **one** advantage of each method described (b).

4. A house built twenty five years ago has an external cavity wall built to the following specification:

Outer Leaf: 100mm concrete block with 19mm cement rendering.
Cavity: 100mm uninsulated
Inner Leaf: 100mm concrete block with 16mm plaster finish.

Wall data:

Thermal conductivity of the rendering and the plaster is 0.46W/m °C.
Conductivity of the blockwork is 1.44W/m °C.
Resistance of the external surface is 0.055m² °C/W.
Resistance of the internal surface is 0.123m² °C/W.
Resistance of the cavity is 0.18m² °C/W.

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

(b) A proposed extension to the house is to have external walls of similar construction to the original, with the addition of expanded polystyrene insulation in the cavity.
Calculate the thickness of insulation needed to achieve the "U-value" of 0.45W/m² °C, given the thermal conductivity, (k-value) of expanded polystyrene is 0.033W/m °C.

(c) Describe in detail, using notes and freehand sketches, two methods that might be employed to reduce the thermal transmittance coefficient, "U-value", of the existing walls.

5. Trial holes indicate that the site, on which a house is to be built, has a loose gravel subsoil.

(a) Discuss in detail the considerations governing the choice of foundation for this house.

(b) Describe, with the aid of notes and detailed sketches, **two** types of foundation that would be suitable for the house.

(c) In the case of each type of foundation selected, state clearly **two** reasons why it is considered suitable.

6. (a) Discuss sound insulation in buildings with reference to each of the following:

(i) Mass;
(ii) Completeness;
(iii) Isolation.

(b) A living room is located on the first floor of a new house, directly above a bedroom. The floor consists of tongued and grooved flooring boards on wooden joists with a plasterboard ceiling beneath.
Using notes and sketches, show **two** design details that will increase the sound insulation properties of the floor and minimise the transmission of noise to the bedroom beneath.

7. Sewage treatment and disposal are to be provided for a new house, situated in a rural area.

(a) Discuss in detail **four** considerations that must be fulfilled to ensure that the site is suitable for the location of a sewage treatment unit.

(b) Using notes and freehand sketches, explain in detail **three** considerations in the design of a septic tank system that ensure the safe processing and disposal of waste.

8. It is proposed to extend the kitchen area of an existing two-storey house. This requires the construction of a timber flat roof to the extension. The external wall of the house is a 300mm insulated cavity wall.

(a) To a scale of 1:5, show the design details of the roof construction at:
(i) eaves level, showing how the rainwater is to be removed.
(ii) the abutment of the flat roof with the wall of the existing house.

(b) Using notes and sketches show two design considerations in the roof construction which prevent the occurrence of:
(i) Condensation within the roof structure;
(ii) Decay of the roof timbers.

9. A loadbearing, timber stud partition with a plaster finish separates a dining room and a living room in the ground floor of a two storey house.

(a) Using notes and freehand sketches, describe in detail, the construction of the partition.

(b) Show clearly the design details necessary to accommodate a standard flush panel door.

(c) Label and give the sizes of each of the components of the partition.

(d) Discuss in detail the advantages and disadvantages of using either a timber stud partition or a concrete block partition wall.

10. In recent years the increase in the building of individual houses in the countryside is causing some debate.

(a) What arguments might be presented by:

(i) a person who wants to live in the country and is seeking to build a one-off house in the countryside and

(ii) a person who is objecting to the building of one-off housing and is seeking to maintain the traditional appearance of the countryside.

(b) Evaluate the arguments presented at (a) and (b) above and make a recommendation.

OR

"Good builders were very conscious of the outward appearance of their work and took care to improve and enhance it, while the use of purely local materials always ensured that the finished structure fitted smoothly into its environment, and did not shock it or do violence, as do some misguided efforts of 'modern' fashion in building."

Irish Country Households (1985) : *Kevin Danaher*

Discuss.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2003

Construction Studies

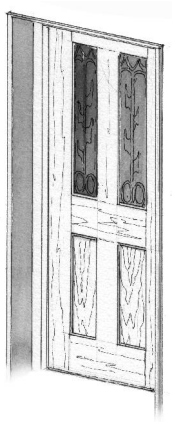
Theory - Higher Level

(300 Marks)

Wednesday 18 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. An external wooden door with four panels is shown in the accompanying sketch. The upper panels are glazed and the lower panels are solid. The door opening is located in a standard 300mm external concrete 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 external wall and door, showing clearly the threshold, the door and the doorframe. The section should show all the constructional details from 300mm below the bottom of the door to 300mm above the top of the doorframe.

(b) Indicate on the drawing **two** design details that ensure that moisture does not penetrate to the inner surfaces surrounding the door.

2. A proposed combined kitchen and dining space in a new house is 6m long by 4.5m wide and has two adjoining external walls. This space is to be user friendly for a person in a wheelchair.

(a) Using a well-proportioned line diagram ***or*** freehand sketch, propose a design layout for the space, indicating the positions you would choose for the following:

- Doors
- Sink
- Storage
- Electric cooker
- Windows
- Work surfaces
- Fridge
- Dining table

(b) Using notes and detailed freehand sketches, outline **two** specific design considerations that would make the proposed layout suitable for a person in a wheelchair.

(c) Discuss in detail **three** other design considerations that influenced the proposed layout.

3. The sketch shows a terrace of townhouses built over one hundred years ago. It has been decided to carry out essential repairs to one of the houses.

A survey of the house reveals:

(i) Original natural slate and rafters;
(ii) Softwood fascia and soffit;
(iii) Original cast-iron rainwater gutters;
(iv) Traditional softwood sliding sash windows;
(v) Random rubble stone walls with weathered sand/cement render.

(a) Select **three** areas that may be in need of repair in a house of this age and for **each** of the areas selected give **two** reasons why you consider the repairs may be necessary.

(b) Describe in detail, using notes and freehand sketches, how **each** of the **three** repairs could be carried out in a manner that would respect the character of the original terrace and that would also ensure that waste is kept to a minimum.

4. Poor design detailing may result in the occurrence of both dry rot and wet rot in a domestic dwelling.

(a) Outline the conditions necessary for the development of each type of rot.

(b) Select **one** location in a domestic dwelling where dry rot may occur and, using notes and sketches, show how the rot may be eliminated.

(c) Using notes and sketches, show the design detailing that would prevent the occurrence of dry rot at the selected location.

5. A dwelling house built in the 1970's has external walls with uninsulated cavities. The owner has decided to insulate the walls of the house. The external walls have the following specification:

Outer leaf: 100mm brick;
Cavity: 75mm – without insulation;
Inner leaf: 100mm concrete block with 16mm plaster finish.

Thermal data of wall:

Conductivity of brickwork	(k)	1.320	W/m °C
Conductivity of blockwork	(k)	1.440	W/m °C
Conductivity of plaster	(k)	0.430	W/m °C
Resistance of the external surface	(R)	0.048	m^2 °C/W
Resistance of the internal surface	(R)	0.122	m^2 °C/W
Resistance of the cavity	(R)	0.170	m^2 °C/W.

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

(b) The owner may choose either of the following methods to increase the insulation properties of the walls:

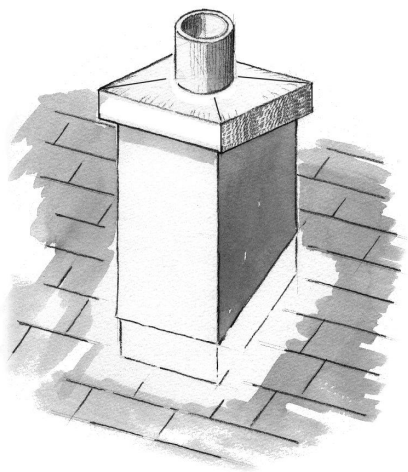
(i) filling the cavity with urea formaldehyde foam ***or***
(ii) fixing insulated plasterboard sheeting to the inside wall surfaces. The insulated sheeting consists of 50mm rigid urethane and 12.5mm plasterboard.

Calculate the U-value for each of the above options given the following thermal data:

Conductivity of urea formaldehyde foam	(k)	0.040 W/m °C
Conductivity of rigid urethane	(k)	0.023 W/m °C
Conductivity of plasterboard	(k)	0.160 W/m °C

(c) Evaluate both methods of insulation listed at (b) above, recommend a preferred method and give **two** reasons to support your recommendation.

6. A concrete block chimney stack with a sand/cement rendering passes through a pitched slated roof, as shown in the sketch.



(a) Using notes and freehand sketches, show the design details necessary to prevent the penetration of water between the chimney stack and the adjoining roof surfaces.

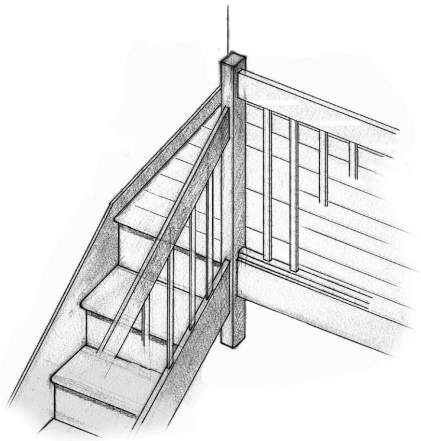
(b) Poor design detailing may result in the occurrence of a down draught in a chimney.
Outline **one** situation in which a down draught might occur and using notes and freehand sketches, show the design detailing that would prevent the occurrence of such a down draught.

7. An oil-fired boiler is used as the heat source to provide central heating and hot water for a domestic dwelling.

(a) Using a single-line diagram, show a design layout for the heating and domestic hot water system. Include three radiators in the proposed layout and indicate suitable dimensions for all pipework.

(b) Using notes and freehand sketches, show **three** design details that should be incorporated into the proposed layout to ensure the continuous safe operation of the heating system.

8. A closed string timber stairs leads to a first floor landing, as shown in the sketch. The landing has a suspended timber floor with tongued and grooved flooring boards on timber joists and a plasterboard ceiling beneath.



(a) To a scale of 1:5 draw a vertical section through the top three steps of the stairs and the landing. Show the newel, balusters and handrail of the stairs.

(b) Using notes and freehand sketches show the design details necessary to support the stairs at the abutment of the stairs and landing.

(c) Using notes and freehand sketches show **two** design details that ensure that the landing is safe for all users.

9. A stormproof casement window made from softwood is located in an external wall and provides natural lighting to a kitchen area**.**

(a) Describe in detail, using notes and freehand sketches, **two** design details that ensure that the window is weather proof.

(b) Discuss **two** advantages and **two** disadvantages of using softwood in the manufacture of windows.

(c) An illuminance of 300 lux is required on a working plane in the kitchen. The daylight factor at a point on the working plane in the kitchen is 5%.
Show by calculation if the illuminance is sufficient, assuming an unobstructed view and the illuminance of a standard overcast sky to be 5000 lux.

10. A detached single-storey house is situated adjacent to a main road on the outskirts of a large town and is within easy reach of the town centre. Planning permission is being sought to demolish this house and to erect a four-storey apartment block on the site.

(a) What arguments might be presented:

(i) In support of the erection of the apartment block;

(ii) In support of the retention of the existing house?

(b) Make a recommendation to the planning authority on this proposal and give **three** reasons in support of your recommendation.

OR

"Vernacular styles of buildings exist all over the world. These styles are characterised by their simplicity, by their use of local materials and by the ease with which they can be constructed. The knowledge required for the creation of such buildings was long regarded as common knowledge and freely available to all. The decline of the vernacular tradition with its simple forms and its accessibility to people has resulted in the loss of the knowledge and skills needed to design and construct small buildings, especially the buildings in which people live – their homes."

Be Your Own Architect (1992) ***: Peter Cowman.***

Discuss.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2004

Construction Studies

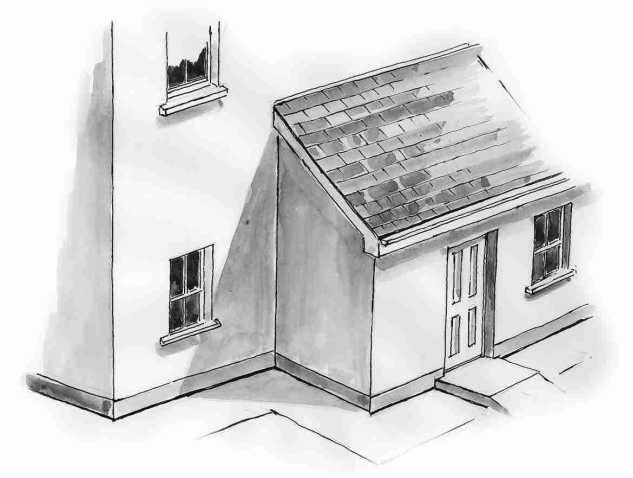
Theory - Higher Level

(300 Marks)

Wednesday 23 June
Afternoon, 2.00 - 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 small porch, which projects 1.7m from a house, is shown in the accompanying sketch. The lean-to roof is slated and has a pitch of 30 degrees. The house and porch are constructed of standard 300mm concrete block walls with insulated cavity. The porch has a level plasterboard ceiling.



(a) To a scale of 1:5 draw a vertical section through the porch showing the roof and wall of the house. The section should show all the construction details from 400mm below the bottom of the ceiling joists to 300mm above the abutment of the roof and wall of the house.

(b) Indicate on your drawing **two** design details that ensure moisture does not penetrate at the abutment of the roof and wall of the house.

2. A bathroom in a new single storey dwelling house measures 3m x 2.5m and has two adjacent external walls. The bathroom is to be suitable for a person in a wheelchair.

(a) Using a well-proportioned line diagram ***or*** freehand sketch, propose a design layout for this space, indicating the location you would choose for each of the following:

- Door
- Water closet (WC)
- Bath ***or*** shower facility
- Window
- Wash hand basin

(b) In the case of each item listed above, discuss in detail two reasons for the chosen location.

(c) Using notes and detailed freehand sketches, outline **two** other design considerations that would make the bathroom space user friendly for a person in a wheelchair.

3. **(a)** Using notes and freehand sketches, describe the application of an external render to the walls a new house of concrete block construction. Give details of materials, mix proportions and sequence of coats required.

(b) The original external render of an old house is to be removed to reveal solid stone walls of random rubble construction, as shown on the sketch. The owner has the option of either leaving the external stonework exposed ***or*** of replastering the walls.

Outline **two** reasons in favour of **each** option listed above.
Recommend a preferred option and give **two** reasons to support your recommendation.

(c) If the house is to be replastered, a 1 lime : 3 sand mix is recommended for the external render. Give **two** reasons why such a mix is recommended for this house.

4. An oil-fired boiler is used as a heat source to provide central heating and hot water in a two-storey dwelling house.

(a) Using a single line diagram, show a design layout for the heating and domestic hot water system. Include three radiators on the ground floor and three radiators on the first floor.

(b) Using notes and sketches describe **three** safety features that are incorporated into the design of an oil-fired boiler to ensure its safe functioning.

(c) Many modern heating systems are designed to allow independent control of different heating zones within a house. Discuss, in detail, **three** advantages of installing a zoned heating system.

5. The roof of a domestic dwelling house built in the 1970's is insulated with a 100mm glass fibre quilt placed between the ceiling joists. It has been decided to increase the level of insulation in the roof to achieve a U-value of 0.16 W/m^2 °C.

This U value may be achieved by either:

(i) increasing the thickness of glass fibre ***or***
(ii) using urethane board.

Thermal data:

U-value of the existing roof		0.35	W/m^2 °C.
Conductivity of glass fibre quilt	(k)	0.04	W/m °C.
Conductivity of urethane board	(k)	0.023	W/m °C.

(a) Calculate the thickness of the (i) glass fibre quilt and (ii) urethane board required to achieve the U-value of 0.16 W/m^2 °C.

(b) Evaluate both methods of insulation listed at (i) and (ii) above.
Based on this evaluation recommend a preferred method of insulation.

(c) Using notes and sketches, show **two** design details that ensure adequate ventilation of the roof space is maintained when the additional insulation is put in place.

6. Inadequate treatment and disposal of sewage creates environmental and health hazards.

(a) Describe **three** hazards that could occur in a sewage treatment and disposal system of an individual house, situated in a rural area, if the system is not properly designed.

(b) Using notes and sketches show how proper design detailing would prevent each of the hazards described at (a) above.

(c) Outline **three** considerations to be taken into account when selecting a site for a house in a rural area to ensure that the site is suitable for the proper treatment and disposal of sewage.

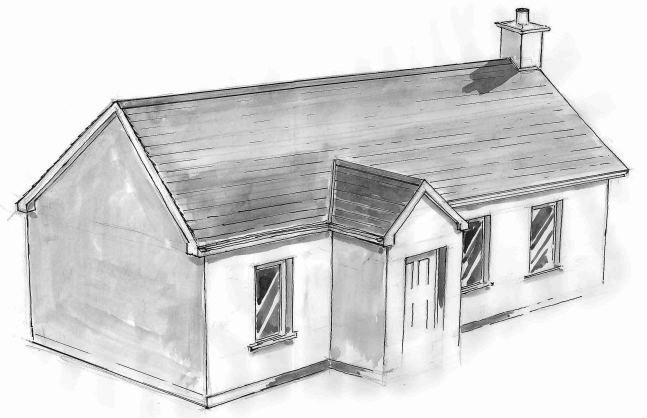
7. A dwelling house has a standard 300mm concrete block external wall with insulated cavity. Poor design detailing can result in the penetration of moisture to the inner leaf of the wall.

(a) Using notes and neat freehand sketches, show **three** locations where moisture may penetrate.

(b) For each location selected show, using notes and neat freehand sketches, the correct design detailing that would ensure that moisture does not reach the inner leaf.

(c) List **two** materials used to prevent the penetration of dampness in buildings. In the case of **each** material listed, state a location where it may be used and explain why the material is particularly suited for use in the location outlined.

8. The sketch shows a new dwelling house with a slated roof pitched at 45 degrees. The roof is a traditional cut roof and is designed to incorporate bedroom accommodation within the attic space.
The house has an internal width of 7.0 metres. The external walls supporting the flooring joists are standard 300mm concrete block walls with insulated cavity. The joists are also supported internally on a centrally located load bearing concrete block wall.



(a) To a scale of 1:20 draw a vertical section through the roof structure. Show the constructional details from the bottom of the wall plates to the top of the ridge board.
(It is not necessary to show slating or window details)

(b) To provide natural light to the bedrooms in the attic space, a choice must be made to fit either pitched dormer windows ***or*** roof light windows.

State **two** arguments in favour of fitting dormer windows and **two** arguments in favour of fitting roof light windows.

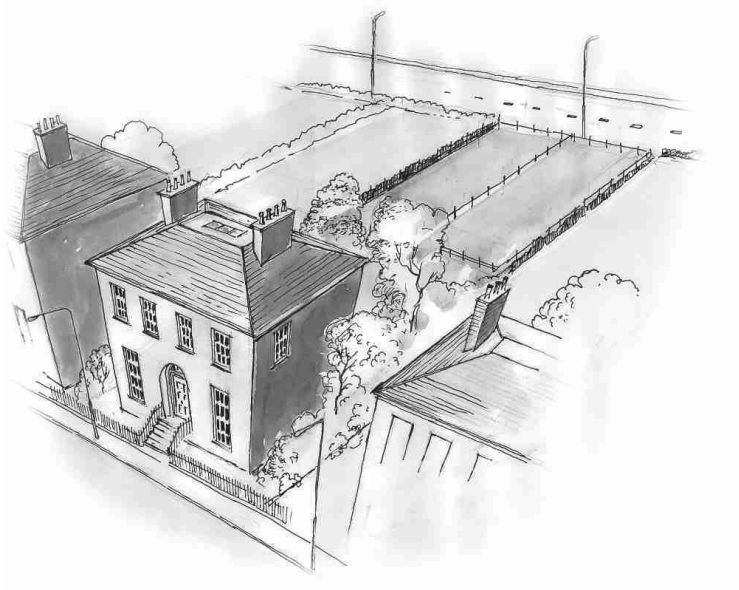
9. It is proposed to install a music system in the living room of a single storey dwelling house.
The house has a concrete floor and the living room is separated from an adjacent bedroom by a standard stud partition. The walls and ceilings have a smooth hardwall plaster finish. It is proposed to carry out renovations to improve sound insulation.

(a) Using neat freehand sketches show **two** design details that would increase the sound insulation properties of the stud partition.

(b) Explain in detail ***two*** sound insulation principles which would influence the design of the stud partition.

(c) Using notes and sketches suggest **two** modifications which would improve the acoustic properties of the living room.

10. A suburban dwelling house, built over one hundred years ago, has a large rear garden with mature trees and shrubs. A roadway provides access to the rear garden, as shown in the sketch.
Planning permission is being sought to divide the rear garden as shown and to erect two townhouses in the divided garden.



(a) What arguments might be presented:

(i) In support of the erection of the townhouses;
(ii) In support of the retention of the property in its original state?

(b) Make a recommendation to the planning authority on this proposal and discuss in detail **three** reasons in support of your recommendation.

OR

"The suburban spread of settlements is wasteful both in terms of its impact on existing fabric and infrastructure of towns, and in terms of the continual erosion of the landscape. If this trend is to be reversed, the built fabric of towns and villages will need to be renewed, and dwellings and related facilities provided which will attract families back to them"

Developing a Government Policy on Architecture (1996).

Discuss.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2005

Construction Studies

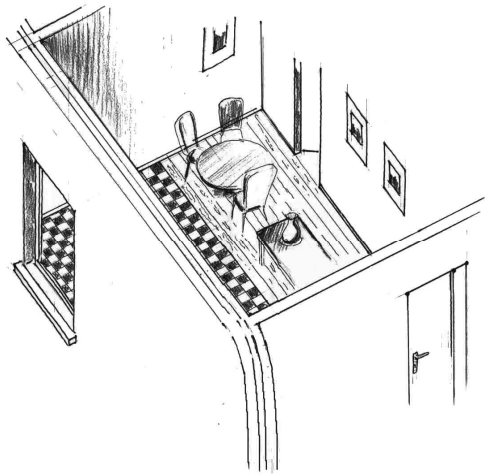
Theory - Higher Level

(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 sketch shows a combined kitchen and dining space in a single storey dwelling house. The external wall is a standard 300mm concrete block wall with an insulated cavity. The kitchen space has a solid concrete floor with a tiled finish and the dining space has a suspended timber floor.



(a) To a scale of 1:10, draw a vertical section through the external wall and ground floor of the house showing both floor constructions. The section should show all the constructional details from the bottom of the foundation to 400mm above finished floor level and include the abutment of both floors.
(For the purposes of this drawing, show a minimum 1.5 metres width for each floor type)

(b) Indicate on the drawing a design detail to show the cross ventilation of the suspended timber floor through the solid concrete floor.

2. Current building regulations require that new dwelling houses be suitable for all, including wheelchair users.

(a) Using notes and freehand sketches, outline **three** areas in a dwelling house that need specific consideration to ensure that the house is suitable for a person in a wheelchair.

(b) Select one of the areas outlined at **(a)** above and using notes and detailed freehand sketches, show **three** specific design considerations that ensure that the space selected is suitable for a wheelchair user.

3. A small rural dwelling house in the vernacular tradition, built in the 1950s, is shown in the accompanying sketch. As part of a general restoration of the house it has been decided to renew the roof of the house and to incorporate bedroom accommodation within the attic space.
A survey of the house reveals:

- Traditional cut roof with original natural slate;
- Softwood fascia and soffit;
- External uninsulated cavity walls of concrete block construction;
- Solid block internal walls.

(a) Using notes and detailed freehand sketches, show the constructional details of the roof structure to facilitate bedroom accommodation within the attic space. Indicate sizes for all roofing components. Show details of the insulation requirements for both walls and roof.

(b) Using notes and freehand sketches, outline **one** method of providing natural light to the bedrooms in the attic space in a manner that will respect the character of the original house.
Discuss **two** advantages of your preferred method of providing natural light to the bedrooms.

4. A new two-storey house has load-bearing and non load-bearing timber stud partitions. The house has a solid concrete ground floor and a suspended timber first floor.

(a) Using notes and detailed freehand sketches, compare the design detailing for the construction of each of the following:

(i) a load-bearing partition to support the first floor joists;

(ii) a non load-bearing partition on the first floor.

(b) Using notes and freehand sketches, show **two** design details that ensure that the transmission of sound is reduced through the stud partition constructed on the first floor.

5. An extension to a dwelling house has a concrete flat roof with an asphalt finish. The total roof surface is 16m^2 in area.
The roof is constructed to the following specification:

(i)	Concrete flat roof slab:	Thickness 175mm
(ii)	Concrete screed:	Thickness 60mm
(iii)	Layer of asphalt:	Thickness 20mm
(iv)	Internal plaster to roof slab:	Thickness 15mm

Thermal data of roof:

Resistivity of asphalt		1.250	m °C/W
Resistivity of concrete screed		0.710	m °C/W
Resistivity of concrete roof slab		0.690	m °C/W
Resistivity of the plaster		2.170	m °C/W
Resistance of the internal surface	(R)	0.104	m^2 °C/W
Resistance of the external surface	(R)	0.413	m^2 °C/W
External temperature		11°C	
Internal temperature		21°C.	

(a) Calculate the U-value of the roof structure and the overall heat loss through the roof.

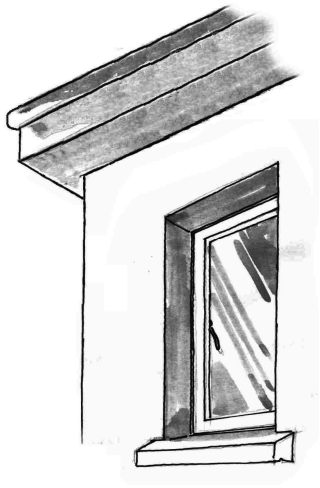
(b) Outline **two** design considerations that must be taken into account in the design of a roof for a domestic dwelling and describe, with the aid of notes and freehand sketches, the design detailing for **each** consideration outlined.

6. **(a)** Draw a single line diagrammatic sketch of the cold water distribution system for a two-storey house. The diagram should show all the design details from the mains supply and include the distribution to the kitchen sink and bathroom. The bathroom includes:
(i) water closet (WC); (ii) wash hand basin; (iii) bath.

(b) Include in the proposed layout all the necessary valves and suggest suitable dimensions for all pipework.

(c) Using notes and detailed freehand sketches, show **two** design details that regulate the level of water in the storage tank and explain the design principles of each.

7. A stormproof casement window, as shown in the accompanying sketch, is made from softwood and has a double-glazed outward opening sash. The window is one metre in height and is fixed in a standard 300mm external concrete block wall with insulated cavity. The wall is plastered on both sides.



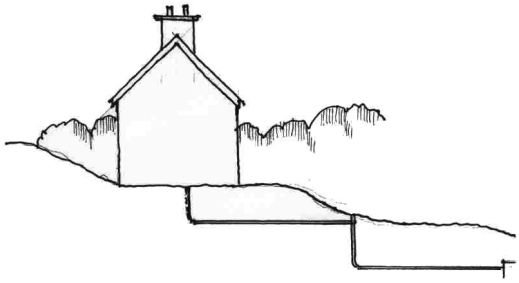
(a) To a scale of 1:5, draw a vertical section through the window frame and opening sash. Show all the constructional details from 300mm below the concrete cill to 200mm above the top of the window frame.

(b) Using notes and freehand sketches, show the design details necessary to prevent the formation of condensation on the inner wall surfaces surrounding the window.

8. A properly designed and constructed sewerage system is essential for the safe removal of waste from a domestic dwelling.

(a) Describe in detail, using notes and freehand sketches, **three** necessary considerations in the design and installation of a sewerage system from a domestic dwelling to either the main sewer or septic tank.

(b) The accompanying sketch shows a house situated on a sloping site. When designing the sewerage system a backdrop manhole is necessary to achieve the correct gradient.



To a scale of 1:10, draw a sectional elevation through the backdrop manhole. The depth from the top of the manhole to the invert level is 1800mm. Show and label all necessary design details.

9. Timber frame construction is now widely used for domestic dwellings in Ireland.

(a) To a scale of 1:10, draw a vertical section through the external wall and ground floor of a house of timber frame construction. The top of a window cill is positioned 900mm above floor level, the external leaf is of standard concrete block construction with a rendered finish and the ground floor is a solid concrete floor with 20mm quarry tile finish. Show all the constructional details from the bottom of the foundation to the top of the concrete cill.

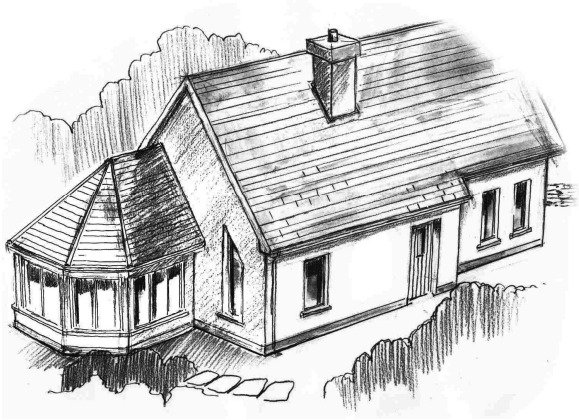
(b) Discuss in detail **two** advantages of timber frame construction and **two** advantages of standard concrete block wall construction and recommend a preferred wall type for a new house.

10. The accompanying sketch shows a house with a sunspace included as shown.

(a) Discuss **three** advantages of including a sunspace, such as that shown in the sketch, in the design layout of a house.

(b) Using notes and sketches, show your preferred orientation for the house and sunspace shown. Outline **two** reasons to support your choice of orientation. (*Indicate clearly the direction of North on your sketch).*

(c) Using notes and sketches, outline **two** design considerations to ensure that optimum thermal benefit is gained from the inclusion of a sunspace.



OR

10. The centres of cities and towns have been subject to depopulation, with a consequent fraying of the urban fabric. The trend towards less intensive urban patterns together with the increasing separation between home, work and town centre have exacerbated the growth in private car transport. This has led to increased energy use and emissions of air pollutants and has militated against the effectiveness of public transport networks.

Ireland's Environment 2004
Environmental Protection Agency (epa);

Discuss the above statement and outline **three** recommendations to the planning authorities which would aid the renewal of the centres of cities and towns.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2006

Construction Studies

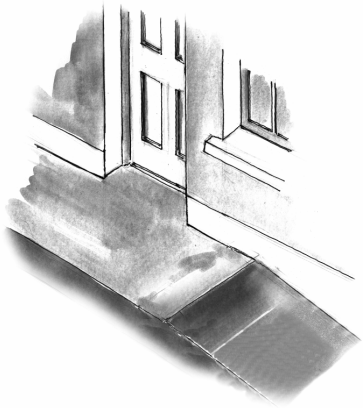
Theory - Higher Level

(300 Marks)

Wednesday 21 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 entrance to a dwelling house, as shown in the accompanying sketch, provides access for a person in a wheelchair. The door opening is located in a 300mm external block wall with an insulated cavity and the door is a solid wooden door. The house has a solid concrete ground floor with a 20mm quarry tile finish.



(a) To a scale of 1:5, draw a vertical section through the external wall and door, showing clearly the threshold and the door. The section should show all the constructional details from the bottom of the foundation to 300mm above finished floor level.

(b) Indicate on the drawing the specific design detailing that ensures that rainwater is removed from the threshold area and does not penetrate to the inner surfaces surrounding the door.

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

(i) Scaffolding;
(ii) Deep Excavation;
(iii) Use of electrical tools out-of-doors.

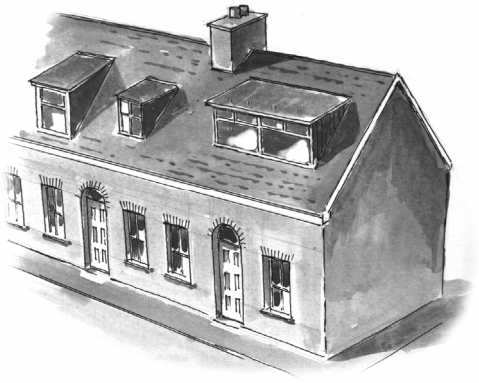
(b) Using ***notes and freehand sketches as appropriate,*** outline **two** specific safety precautions that demonstrate best practice in order to eliminate **each** risk identified at (a) above.

(c) Under the Safety, Health and Welfare at Work Regulations, it is compulsory for employers to have a safety statement. Discuss in detail **two** benefits of such a safety statement for employees in the construction industry.

3. It is proposed to provide bedroom accommodation in the attic space of a new house. The house has an internal width of 6.5 metres and the flooring joists are supported internally on a centrally located load-bearing wall. The roof is a traditional cut roof, is slated and has a pitch of 45 degrees.

(a) Using ***notes and detailed freehand sketches,*** show the constructional details of the roof structure to facilitate bedroom accommodation in the attic space. Indicate clearly the ventilation **and** insulation detailing of the roof structure.

(b) The accompanying sketch shows a terrace of townhouses. The dormer windows have been developed in an uncoordinated manner over a number of years. Using ***notes and freehand sketches,*** suggest a revised design for the dormer windows that would improve the visual appearance of the houses and enhance the character of the terrace.



4. Investigations indicate that a site on which a house is to be built has a moderately firm clay subsoil. Consideration is being given to using either a traditional strip foundation **or** a raft foundation.

(a) Show, with the aid of ***notes and freehand sketches,*** the design detailing for **each** type of foundation listed above. Indicate typical dimensions for each foundation.

(b) Recommend **one** of the above foundation types for the house and give **two** reasons in support of your recommendation.

(c) Identify **two** factors that could adversely affect the strength of concrete in a foundation.

5. The external wall of a timber framed house has the following specification:

External Plaster	thickness	15 mm
Block outer leaf:	thickness	100 mm
Timber stud inner leaf :	thickness	125 mm
Urethane board insulation:	thickness	100 mm
Plasterboard:	thickness	12.5 mm

Thermal data of outer leaf :

Resistance of the external surface	(R)	0.048 m^2 °C/W
Resistivity of the external plaster	(r)	2.170 m °C/W
Conductivity of block	(k)	1.320 W/m °C

Thermal data of inner leaf :

Conductivity of urethane board	(k)	0.023 W/m °C
Conductivity of plasterboard	(k)	0.160 W/m °C
Resistance of the internal surface	(R)	0.104 m^2 °C/W
Resistance of the cavity	(R)	0.170 m^2 °C/W

Ignore the timber studs of inner leaf.

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

(b) Calculate the annual cost of the heat loss through the external wall of the timber framed house outlined above, using the following data:

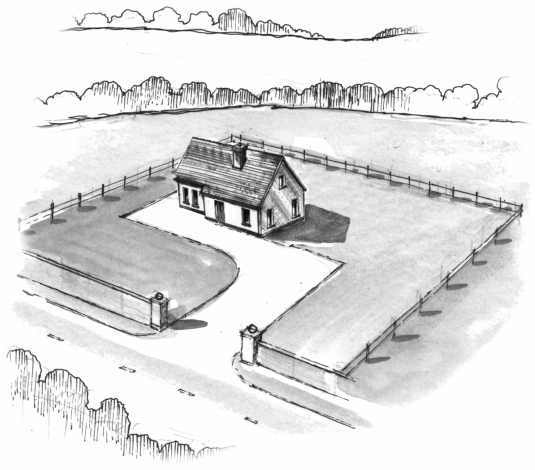
Total external wall area:	125 m^2
Average internal temperature:	18 °C
Average external temperature:	6 °C
U-value of wall:	as calculated at **(a)** above
Heating period:	12 hours per day for 40 weeks per annum
Calorific value of oil:	37350 kj per litre
Cost of heating oil:	65 cent per litre
1000 Watts =	1 kj per second.

(c) Show, with the aid of ***notes and freehand sketches,*** a design detail which will prevent moisture reaching the insulation material from inside the building.

6. Many local planning authorities provide guidelines outlining good practice to be followed when locating a dwelling house in the countryside.

(a) Discuss in detail **three** planning guidelines that you consider should be observed when locating a dwelling house in the countryside.

(b) The accompanying sketch shows a newly built house in a rural setting. Using ***notes and freehand sketches***, outline in detail **two** proposals that would minimise the visual impact of the newly built house and thus help integrate the house into the landscape.



7. **(a)** To a scale of 1:10, draw a vertical section through the window, the external wall and the roof of a timber-framed house, as shown in the sketch. The external leaf is of concrete block construction with a rendered finish. The roof has prefabricated trussed rafters, is slated and has a pitch of 45 degrees. Show all the constructional details from 300mm below the window head, through the eaves and include three courses of slate.

(b) On the drawing, label and indicate the typical dimensions of **four** main structural members.

8. A single stack system is commonly used to discharge soil and waste from a domestic dwelling.

(a) Show, with the aid of ***notes and detailed sketches,*** a typical layout of a single stack system for a bathroom, situated at first floor level of a dwelling house. Show **two** design considerations relating to the location of the bathroom fittings and include the typical sizes of all waste pipes.

(b) Using ***notes and freehand sketches***, show **two** design details that ensure the pipework in an underground drainage system is watertight.

(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.

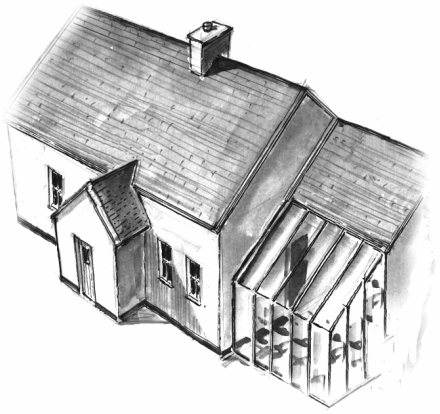
9. The accompanying sketch shows two semi-detached houses.

(a) Using ***notes and freehand sketches,*** show **two** design details that would help restrict the spread of fire between the houses.

(b) Using ***notes and freehand sketches,*** show **two** design details that would facilitate escape from a domestic dwelling in the event of an outbreak of fire.

(c) A smoke detection system is compulsory in all new residential dwellings. Outline **two** considerations to be observed when fitting a smoke detection system in a house.

10. In order to maximise passive solar gain, a fully-glazed sunspace is included in the design of the house shown in the accompanying sketch.



(a) Using ***notes and freehand sketches***, outline **two** considerations that should be taken into account when incorporating a fully glazed sunspace into a dwelling house.

(b) Using ***notes and freehand sketches***, show your preferred orientation for the house and sunspace shown. Outline **two** reasons to support your choice of orientation.
(*Indicate clearly the direction of North).*

(c) Using ***notes and freehand sketches***, outline **two** considerations in the design of the house that would help maximise the solar gain from such a sunspace.

OR

"The sustainable neighbourhood is, in many respects, based on the traditional urban neighbourhoods common in cities over many centuries. The pattern has numerous advantages over that of suburban sprawl. It involves much less car dependence for daily tasks and can be much more easily served by effective public transport".

Housing in Ireland: Performance and Policy
National and Economic Social Council (NESC)

Discuss the above statement in detail and outline **three** recommendations to the planning authorities which would create better planned urban neighbourhoods and reduce dependency on the private car.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2007

Construction Studies

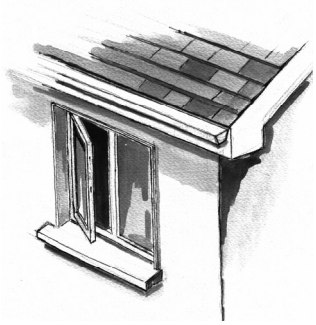
Theory - Higher Level

(300 Marks)

Wednesday, 20 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 sketch shows portion of a single storey dwelling house having a 300 mm concrete block external wall with insulated cavity. The house has an internal span of 5.0 metres. The window shown is an outward opening double-glazed wooden casement window 1.2 metres in height.
The roof, which is slated, is a traditional cut roof pitched at 30 degrees and the ceiling joists are supported centrally on a load-bearing concrete block wall.



(a) To a scale of 1:10, draw a vertical section through the external wall, window and roof structure.
The section should show the typical construction details from 300 mm below the concrete cill, through the fixed frame of the window and include the roof. Show three courses of slate at eaves.

***Note**: Show the details for one external wall and half the roof including the ridge.*

(b) Indicate on the drawing the design detailing which ensures that moisture does not penetrate to the inner wall at the window head.

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

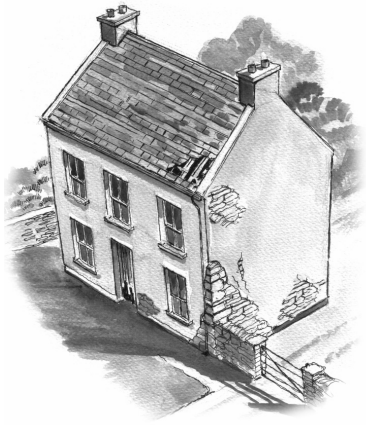
(i) Slating a steeply pitched roof of a two storey house;
(ii) Working around a stairwell prior to having the stairs fitted;
(iii) Placing a ladder against a scaffold.

(b) Using ***notes and freehand sketches,*** discuss in detail **two** safety precautions that should be observed to eliminate **each** risk outlined at **(a)** above.

(c) Discuss in detail **three** reasons that make a construction site a high risk area for accidents at work.

3. A house over 100 years old, in the vernacular tradition, is shown. A survey of the house indicates **three** areas in need of immediate repair:

- ***Roof***: traditional cut roof with natural slates;
- ***Windows***: single-glazed, painted softwood, sliding sash;
- ***External walls***: thick random rubble stone walls with a lime render.



(a) Describe in detail, using ***notes and freehand sketches,*** how repairs to ***each*** area listed above could be carried out in a manner that respects the character of the original house.

(b) Describe, using ***notes and freehand sketches,*** how repairs to the roof and windows could be carried out in a manner that ensures the reuse of materials so that that waste is kept to a minimum.

4. A suspended timber ground floor abuts a 300 mm concrete block external wall of a dwelling house.

(a) Using ***notes and freehand sketches*** show the construction details of the wall and the suspended timber ground floor from foundation to finished floor level. Indicate clearly the position of a radon barrier and give typical sizes and materials of the floor components.

(b) Discuss in detail **two** functional requirements of a suspended timber ground floor for a domestic dwelling.

5. **(a)** Using the following data, calculate the U-value for the external wall of a house, built in the 1970s:

External plaster	thickness	16 mm
Block outer leaf	thickness	100 mm
Cavity (un-insulated)	width	100 mm
Block inner leaf	thickness	100 mm
Internal plaster	thickness	13 mm

Thermal data of external wall :

Conductivity of plaster	(k)	0.430 W/m °C
Conductivity of blockwork	(k)	1.440 W/m °C
Resistance of external surface	(R)	0.048 m^2 °C/W
Resistance of cavity	(R)	0.170 m^2 °C/W
Resistance of internal surface	(R)	0.122 m^2 °C/W

(b) Using the following data, calculate the cost of the heat lost annually through the un-insulated external wall:

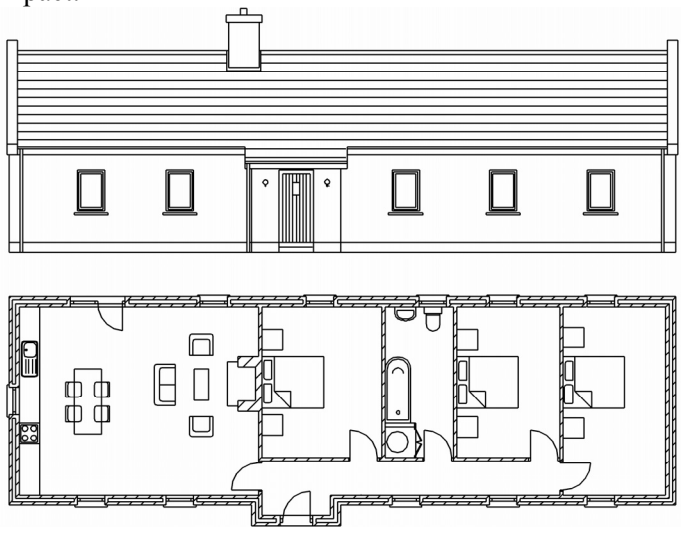
Area of external wall	145 m^2
Average internal temperature	18 °C
Average external temperature	5 °C
U-value of wall	as calculated at **(a)** above
Heating period	10 hours per day for 42 weeks per annum
Cost of oil	68 cent per litre
Calorific value of oil	37350 kj per litre
1000 Watts =	1kj per second.

(c) It is proposed to insulate the external walls of the house to improve their U-value.
Using ***notes and freehand sketches,*** show **one** method of insulating the external walls to meet the requirements of the current Building Regulations.

6. **(a)** Using ***notes and freehand sketches,*** discuss in detail **three** planning guidelines that should be observed when siting a new house in a rural area to ensure that the house is integrated sensitively into the landscape.

(b) The accompanying drawing shows a house based on the traditional Irish cottage. The house is designed to have low environmental impact.

Using ***notes and freehand sketches,*** outline **two** features in the design of the house that reflect a traditional cottage and discuss in detail how **each** feature contributes to reducing the environmental impact of the house.



7. A four-panel wooden door is fixed in the external wall of a two storey timber-frame house, as shown in the sketch. The external wall, which supports the first floor joists, has a concrete block outer leaf with a rendered finish.

(a) To a scale of 1:10, draw a vertical section through the external wall, door and floor joists. The section should show the typical construction details from 400 mm below the head of the door frame to 400 mm above the first floor joists. Show clearly the external wall, the door, door frame and the first floor joists. Indicate the typical dimensions of **four** main structural members.

(b) On the drawing, show clearly how the first floor joists are supported at the timber-frame inner leaf of the external wall.

8. **(a)** Using ***notes and a single-line diagram,*** show a typical layout of an oil-fired central heating and hot water system for a two storey dwelling house. Show **three** radiators on each floor, indicate the necessary valves and give typical sizes of the pipework.

(b) On the diagram, show **two** features that ensure the safe functioning of the heating system.

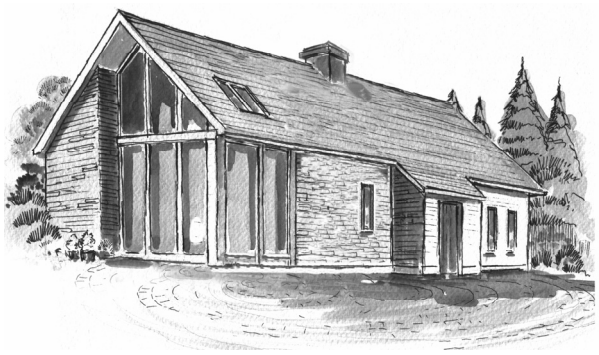
(c) Using ***notes and freehand sketches,*** show **two** details that should be incorporated into the design of the central heating system to ensure the economical use of oil.

9. The accompanying sketch shows two semi-detached houses.

(a) Using ***notes and freehand sketches,*** show **two** design details that reduce the transmittance of sound between the two houses and explain the sound insulation principles associated with **each** design detail.

(b) The first floor consists of tongued and grooved softwood flooring on timber joists with a plasterboard ceiling beneath.
Using ***notes and freehand sketches,*** show **two** design details that would increase the sound insulation properties of the first floor in order to minimise the transmittance of sound.

10. A house with an integrated sunspace is shown in the accompanying sketch.



(a) Using ***notes and freehand sketches,*** show the preferred orientation for the house and sunspace relative to the path of the sun. (*Indicate clearly the direction of North).*

(b) Using ***notes and freehand sketches,*** propose a layout for the rooms adjoining the sunspace and show how the proposed layout would maximise the benefit of the solar gain from the sunspace.

(c) Using ***notes and freehand sketches,*** outline **two** design details for the building fabric that would help store the heat gained from the sunspace.

OR

10. "Developing the sustainable neighbourhood is, by its very nature, about much more than higher densities and the choice of a few eco-friendly materials. It involves the integration of economic, community and social sustainability objectives with the physical planning of the neighbourhood. It requires casting these - along with energy use, public transport, recycling, active green space, the hierarchy of streets etc. - into a comprehensive neighbourhood plan".

The Sustainable Neighbourhood: by Brian Brennan in
The New Housing: The Royal Institute of Architects of Ireland

Discuss the above statement in detail and outline **three** recommendations to the planning authorities that would help create better planned sustainable neighbourhoods.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2008

Construction Studies

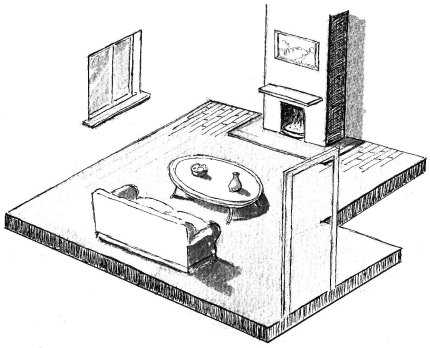
Theory - Higher Level

(300 Marks)

Wednesday, 18 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. An open fireplace is located on the party wall between two semi-detached houses, as shown in the accompanying sketch. The party wall is a 300 mm solid block wall and the ground floor is a concrete floor with a 25 mm woodblock finish.



(a) To a scale of 1:5, draw a vertical section through the ground floor, hearth and fireplace. The section should show all the construction details from the bottom of the foundation to the top of the second flue liner.
Include **four** typical dimensions on your drawing.

(b) Indicate clearly on the drawing how the flue liners are joined to ensure the safe removal of smoke and gasses from the fireplace.

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

(i) fitting a concrete window cill on the second storey of a dwelling house;
(ii) laying pipes in a deep trench;
(iii) excavating in an area where there are underground electrical cables.

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

(c) Discuss in detail **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. Poor design detailing or workmanship can result in the formation of thermal (cold) bridges, causing significant heat loss through the external fabric of a building.

(a) Outline **three** areas in a dwelling house where thermal bridges are likely to occur and using notes and ***freehand sketches***, show the correct design detailing which will prevent the formation of thermal bridges in each location outlined.

(b) A house built in the 1980s has 50 mm expanded polystyrene insulation in the cavity of the external wall. Using notes and ***freehand sketches,*** show **two** methods of upgrading the thermal properties of the external envelope of the house to meet the requirements of the current Building Regulations.

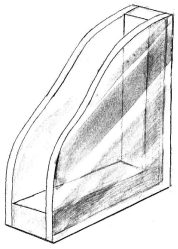
4. **(a)** Discuss in detail, using notes and ***freehand sketches,*** **three** functional requirements of a wastewater treatment system suitable for the on-site treatment of sewage from a single house.

(b) Using notes and ***freehand sketches,*** show the plan of a typical on-site wastewater treatment system for a single house. Include **three** main dimensions in your sketch.

(c) Using notes and ***freehand sketches,*** describe **one** test that is carried out to determine if a site is suitable for an on-site treatment system.

5. It is proposed to replace the single glazing in a dwelling house with double glazing.

(a) Using the following data, calculate the U-value of the:
(i) single glazing;
(ii) standard double glazing.



Glass: single glazing	thickness	5 mm
Glass: double glazing	thickness	4 mm
Space between panes	width	12 mm

Thermal data of glazing:

Conductivity of glass	(k)	1.020 W/m °C
Resistance of space between panes	(R)	0.170 m^2 °C/W
Resistance of internal surface	(R)	0.122 m^2 °C/W
Resistance of external surface	(R)	0.080 m^2 °C/W

(b) A choice is to be made between the following types of double glazing:
- standard double glazing;
- low-emissivity (low-e) double glazing.

Using the U-values obtained at **(a)** above and the following data, calculate the cost of the heat lost annually through **each** of the following:
- single glazing;
- standard double glazing;
- low-e double glazing.

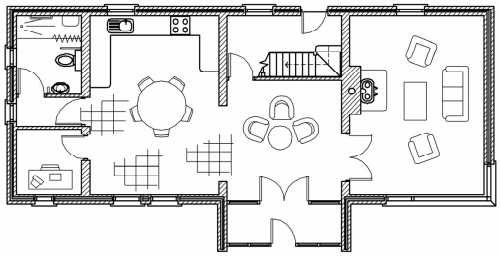
U-value of low-e double glazing:	1.1 W/m^2 °C
Area of glazing:	25 m^2
Average internal temperature:	18 °C
Average external temperature:	5 °C
Heating period:	11 hours per day for 40 weeks per annum
Cost of oil:	80 cent per litre
Calorific value of oil:	37350 kj per litre
1000 Watts:	1kj per second.

(c) Using the information obtained at **(b)** above, recommend a preferred glazing type and give **two** reasons to support your recommendation.

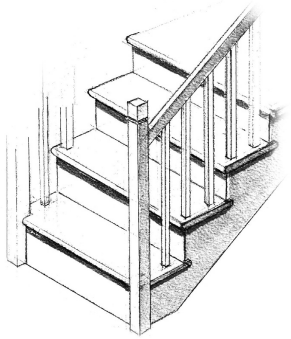
6. **(a)** Using notes and ***freehand sketches***, discuss the importance of **each** of the following when siting a house sensitively in a rural landscape:
- location of house in the landscape;
- scale of house;
- form of house;
- choice of materials.

(b) The accompanying drawing shows the elevation and ground floor plan of a house designed to have low environmental impact.
The house has three bedrooms and a bathroom in the attic space.

Using notes and ***freehand sketches,*** discuss in detail **three** features in the design that contribute to reducing the environmental impact of the house.



7. A cut-string timber stairs suitable for a domestic dwelling is shown in the accompanying sketch.



(a) To a scale of 1:5, draw a vertical section through the bottom four steps of the stairs. Include the newel post and balustrade and show the typical dimensions of **four** main structural members of the stairs.

(b) Using notes and ***freehand sketches*** show **two** design features that ensure that the stairs is safe for all users.

8. **(a)** An oil-fired central heating and hot water system for a two storey dwelling house is designed to provide independent control of hot water and space heating.
Using notes and a ***single-line diagram,*** show a typical layout for such a system.
Show **three** radiators on each floor, indicate the necessary control valves and give the typical sizes of the pipework.

(b) On a separate diagram show an alternative system for providing domestic hot water which is not dependent on fossil fuels. Discuss **two** advantages of the proposed system.

9. **(a)** Using notes and ***freehand sketches***, show the electrical wiring layout for two lights and two switches in a radial circuit of a dwelling house.
Indicate on the sketch the typical sizes and colour coding of the electric cables.

(b) Using notes and ***freehand sketches,*** show **two** safety features in the design of the lighting circuit that ensure that it is safe for all users.

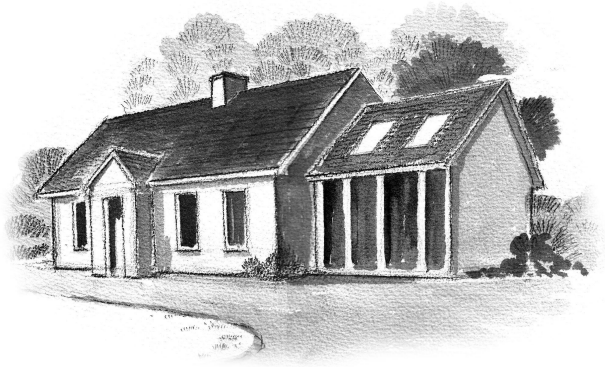
(c) Using notes and ***freehand sketches,*** show **two** features that should be incorporated into the design of the lighting system of a dwelling house to ensure the economical use of electricity.

10. The following considerations are important in passive solar design:

- insulation;
- orientation and shade;
- energy efficient glazing and frames.

(a) Using notes and ***freehand sketches***, discuss in detail the importance of **each** of the above in the design of a passive solar house.

(b) The accompanying sketch shows a dwelling house with an attached sunspace. Using notes and ***freehand sketches,*** propose a design layout for the rooms adjoining the sunspace that would maximise the passive solar heat gain from the sunspace.



(c) Give **two** reasons for the proposed room layout adjoining the sunspace.

OR

10. "All we really ask of our houses is that they keep us warm and dry and protect us from intruders. At the moment we achieve this with huge wastage of energy and material. Our simple demands should be obtainable through passive means utilizing only local materials in all but the least hospitable landscapes. Over the last century using fossil fuel reserves has made us lazy in this regard, because in fact, like the houses of animals, our architectural heritage of vernacular buildings were simple, smart and easy to construct".

Rural: by **Dominic Stevens**.
mermaid turbulence, cloone, leitrim, ireland. (2007)

Discuss in detail the above statement and outline **three** recommendations to the planning authorities that would help create sustainable housing development.

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2009

Construction Studies

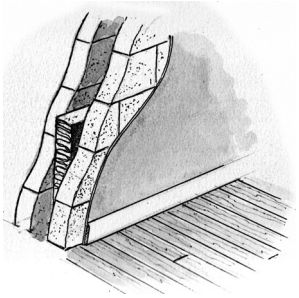
Theory - Higher Level

(300 marks)

Wednesday, 17 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. An insulated suspended timber ground floor abuts the external wall of a dwelling house, as shown in the accompanying sketch. The external wall is a 350 mm concrete block wall with a 150 mm cavity. Rigid insulation board is fixed in the cavity. The suspended timber floor 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 the suspended timber ground floor. The section should show all the construction details from the bottom of the foundation to 400 mm above finished floor level. Include **four** typical dimensions on your drawing.

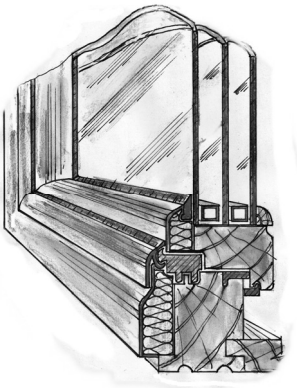
(b) Indicate clearly the position of a barrier that would prevent radon gas entering the dwelling.

2. **(a)** Discuss in detail **two** functional requirements of a foundation for a dwelling house.

(b) Using notes and ***freehand sketches*** show **three** different foundation types suitable for a dwelling house. Show the position of the reinforcing and indicate typical dimensions of each foundation type.

(c) Discuss **two** factors that must be taken into account to ensure the maximum strength of concrete in a foundation.

3. **(a)** Discuss in detail, using notes and ***freehand sketches*** as appropriate, **two** functional requirements of a contemporary glazing system for a modern dwelling house.



(b) The sketch shows a portion of a high performance wooden window with an aluminium external cladding. Discuss the design of the window with reference to:

- environmental considerations
- thermal properties.

(c) Recommend a preferred window frame and glazing system for a new house and give **two** reasons in support of your recommendations.

4. A main bathroom, as shown in the sketch, is located on the first floor of a dwelling house.

(a) Using notes and ***freehand sketches*** show **two** design considerations that should be taken into account when locating the bathroom on the first floor of a dwelling house.

(b) Using notes and ***freehand sketches*** show the above-ground pipework necessary for the safe discharge of waste from the following fittings:

- wash hand basin
- bath.

Include in your sketch typical sizes of the waste pipe for each fitting.

(c) Using notes and ***freehand sketches*** show the design detailing necessary to prevent the penetration of sewer gases into the bathroom at the W.C.

5. **(a)** Calculate the U-value of the external wall of a new dwelling house, given the following data:

External render	thickness	12 mm
Concrete block outer leaf	thickness	100 mm
Cavity	width	150 mm
Insulation	thickness	100 mm
Concrete block inner leaf	thickness	100 mm
Internal plaster	thickness	15 mm

Thermal data of external wall of new house:

Resistance of external surface	(R)	0.048 m^2 °C/W
Conductivity of external render	(k)	1.430 W/m °C
Conductivity of concrete blocks	(k)	1.440 W/m °C
Resistance of cavity	(R)	0.170 m^2 °C/W
Conductivity of insulation	(k)	0.018 W/m °C
Conductivity of internal plaster	(k)	0.430 W/m °C
Resistance of internal surface	(R)	0.122 m^2 °C/W

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

- the new house specified at **5(a)** and
- a house built in the 1970s with an external wall U-value of 1.80 W/m^2 °C.

Thermal data:

Area of external wall	152 m^2
Average internal temperature	17 °C
Average external temperature	6 °C
U-value of wall of new house	as calculated at **5(a)** above
U-value of wall of 1970s house	1.80 W/m^2 °C
Heating period	11 hours per day for 41 weeks per annum
Cost of oil	65 cent per litre
Calorific value of oil	37350 kJ per litre
1000 watts	1kJ per second.

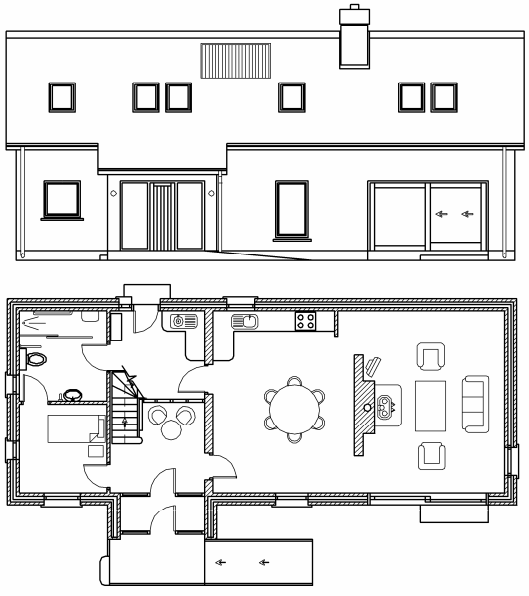
(c) Using notes and ***freehand sketches*** show **one** method of upgrading the thermal properties of the external wall of the house built in the 1970s to meet the requirements of the current Building Regulations.

6. **(a)** Discuss in detail **three** advantages of designing a house to have low environmental impact.

(b) The accompanying drawing shows the elevation and ground floor plan of a house. The house has two additional bedrooms and a bathroom in the attic space.

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 low environmental impact:

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

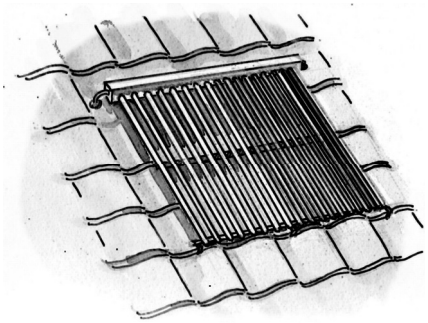


7. A new house with an internal width of 7.0 metres, has a traditional cut roof which is slated and has a pitch of 45 degrees, as shown in the accompanying sketch. The roof is designed to incorporate bedroom accommodation in the attic space.
The external wall supporting the floor joists of the attic is of timber frame construction with a concrete block outer leaf. The floor joists are supported internally on a centrally located load-bearing wall.

(a) To a scale of 1:10 draw a vertical section through one half of the roof structure from eaves to ridge, showing one external wall and one rafter length. Show all the construction details from 400 mm below the floor joists to the ridge and include three courses of slate at eaves. Include **four** typical dimensions of the roof structure.

(b) Indicate clearly on the drawing the design detailing to show the continuity of insulation from the wall to the roof structure.

8. **(a)** An oil-fired boiler 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 design layout for the pipe work necessary for each zone. Show **three** radiators on each floor, indicate the control valves and give the typical sizes of the pipework.



(b) A roof mounted solar collector, as shown in the accompanying sketch, is to be connected to the system at **8(a)** above, to heat domestic hot water only. Show the pipework necessary to connect the solar collector to the above system.
Outline **two** advantages of connecting a solar collector to the system.

9. Careful design detailing is required to improve the air-tightness performance of a dwelling house.

(a) Identify **three** possible air leakage routes in a dwelling house and, with the aid of notes and ***freehand sketches,*** show clearly the correct design detailing that will improve the air-tightness level at each air leakage route identified.

(b) Discuss in detail **two** advantages of improving the air-tightness performance of a dwelling house.

10. **(a)** Using notes and ***freehand sketches*** discuss in detail the importance of **any two** of the following in the design of a passive solar house:

- insulated building envelope
- controlled air changes
- optimum benefit from passive solar gain.

(b) The accompanying sketch shows a terrace of houses with fully glazed façades. Using notes and ***freehand sketches*** show the preferred orientation of the houses to maximise passive solar gain. Justify your choice of orientation.

(c) Overheating may occur in summer as a result of glazing the full façade as shown. Using notes and ***freehand sketches*** show, for one of the houses, **two** design details that would help prevent such overheating.

OR

10. "I think the next challenge for Ireland is not about house building but about remedying a lot of mistakes made at all scales, from regional planning down to house design. Architects should be leading the way and demonstrating how the green agenda can become a very attractive way of thinking about architecture. If we stick to the elements of architecture – light, form and space – and look to the sun as a 'planet' that almost gives life, we can find very interesting ways of using light. You can argue that the bulk of housing stock in Ireland took no cognition of orientation; where the kitchen area was facing - simple things like that coincide with architecture and green design. A lot of these things were forgotten and not questioned, probably because we got used to the idea of being able to cancel out poor orientation with heating."

Extract from interview with Seán Ó Laoire, President RIAI in: *House* (2008). Nova Publishing Ltd, 9 Sandyford Office Park, Sandyford, Dublin18.

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

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination, 2010

Construction Studies

Theory - Higher Level

(300 marks)

Wednesday, 23 June
Afternoon, 2:00 - 5:00

(a) *Answer* ***Question 1*** *and* ***four*** *other questions.*

(b) *All questions carry equal marks.*

(c) *Answers must be written in ink.*

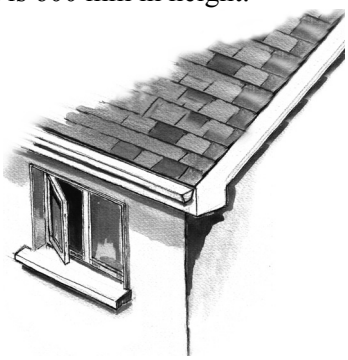
(d) *Drawings and sketches to be made in pencil.*

(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 sketch shows portion of an external wall, roof and a window of a dwelling house. The external wall is a 350 mm concrete block wall with an insulated cavity. The roof has prefabricated trussed rafters, it is slated and has a pitch of 30 degrees. The house has an internal span of 6.0 metres. The window is an outward opening triple-glazed wooden casement window and is 600 mm in height. The fixed frame of the window is 150 mm × 80 mm.

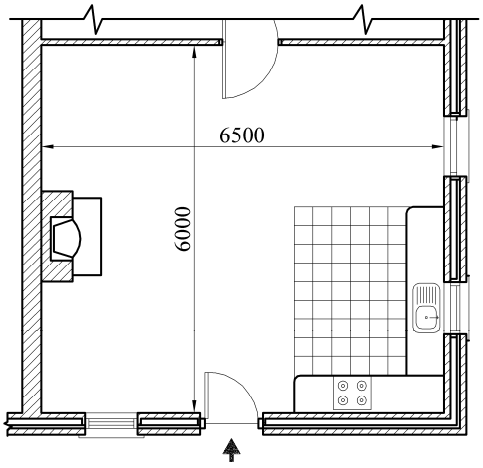


(a) To a scale of 1:10, draw a vertical section through the external wall, window and roof structure. The section should show the typical construction details from 300 mm below the concrete cill, through the fixed frame of the window and include the roof to the level of the ridge. Include **four** typical dimensions of the roof structure.

(b) Indicate clearly on the drawing how the cavity is closed at wallplate level.

***Note**: Show the details for one external wall, one half of the roof from eaves to ridge level and include three courses of slate at eaves.*

2. The accompanying diagram shows an open-plan living, dining and kitchen space suitable for a person in a wheelchair. The floor is an insulated solid concrete ground floor.



(a) Using notes and ***freehand sketches*** show the design detailing at the entrance door to ensure that rainwater is removed from the threshold area and that the entrance is suitable for a person in a wheelchair.

(b) From the given diagram, select any **two** areas that need specific consideration to ensure suitability for a person in a wheelchair. For **each** area selected, using notes and ***freehand sketches,*** show the specific design detailing that ensures ease of use for a person in a wheelchair. Indicate on your design sketches typical dimensions as appropriate.

3. The external wall of a dwelling house built in the 1970s is a 300 mm concrete block wall with 40 mm expanded polystyrene insulation in the cavity. It has been decided to upgrade the thermal properties of the external wall by using either:

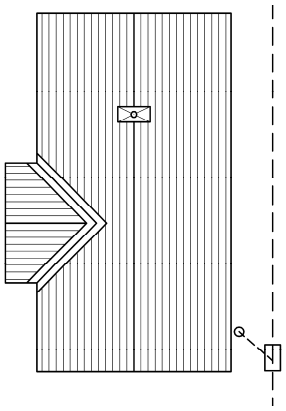
- an internal insulation system *or*
- an external insulation system.

(a) For **each** of the insulation systems outlined above, show using notes and ***freehand sketches,*** one method of applying the insulation material. For **each** insulation system, include the following in your sketches:

- method of fixing
- insulation material and its thickness
- surface finish.

(b) Discuss in detail **two** advantages of each system of insulation and recommend a preferred system of insulation for the house outlined above.

4. **(a)** Discuss, using notes and ***freehand sketches,*** **three** functional requirements of a below ground drainage system to ensure the safe removal of sewage from a domestic dwelling.



(b) The accompanying sketch shows the location of a manhole at the intersection of a branch drain and a main drain in a below ground drainage system for a domestic dwelling. Using notes and ***freehand sketches,*** show the typical construction details through the manhole from the foundation to the manhole cover. Indicate on the sketch the typical dimensions.

(c) Using notes and ***freehand sketches,*** describe in detail **one** test that may be carried out to ensure that the below ground drainage system is watertight.

5. **(a)** Calculate the U-value of an uninsulated external solid concrete wall of a dwelling house built in the 1950s given the following data:

External render	thickness	16 mm
Solid concrete wall	thickness	225 mm
Internal plaster	thickness	13 mm

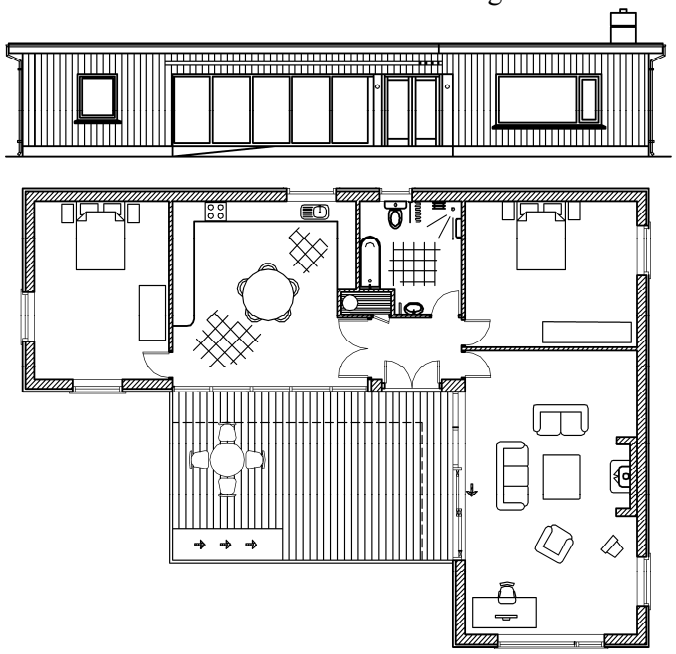
Thermal data of external wall of house:

Resistivity of the solid concrete wall	(r)	1.190 m °C/W
Resistivity of external render	(r)	2.170 m °C/W
Resistivity of internal plaster	(r)	6.250 m °C/W
Resistance of external surface	(R)	0.048 m^2 °C/W
Resistance of internal surface	(R)	0.122 m^2 °C/W

(b) Phenolic foam insulation is to be fitted to the external surface of the solid concrete wall. Given the conductivity (k) of phenolic foam as 0.025 W/m °C, calculate the thickness of phenolic foam required to achieve a U-value of 0.27 W/m^2 °C.

(c) Discuss in detail, using notes and ***freehand sketches,*** the importance of thermal mass in improving the thermal performance of a dwelling house.

6. The drawing shows the design of a timber frame house with an external wooden cladding and a flat roof. The house is designed to have low environmental impact.

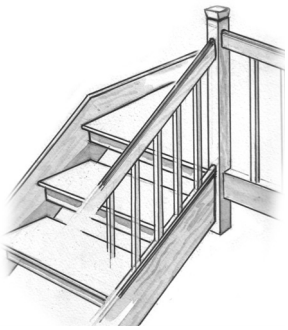


(a) Discuss in detail, using notes and ***freehand sketches,*** **three** design features that contribute to reducing the environmental impact of the house shown.

(b) Discuss in detail the importance of **each** of the following when choosing materials for an environmentally sustainable house:

- renewable
- durable
- locally sourced.

7. The top portion of an open riser timber stairs is shown in the accompanying sketch. The first floor landing has a suspended timber floor with 25 mm hardwood flooring on timber joists and a plasterboard ceiling beneath.
The newel post is 100 mm × 100 mm.



(a) To a scale of 1:5 draw a vertical section through the top three steps of the stairs and landing. Show the newel post, balusters and handrail of the stairs. Indicate on the drawing the:

- handrail height to stairs
- handrail height to landing
- spacing between balusters.

(b) Using notes and ***freehand sketches,*** show **two** safety features in the design of an open riser stairs to ensure that the stairs is safe for all users.

8. **(a)** Determine by degree of efficiency method, or by any other suitable method, the approximate size of a vertical window for a living room 5.0 metres long by 3.8 metres wide requiring an average illumination of 150 lux on the working plane.
Assume an unobstructed view and the illumination of a standard overcast sky to be 5000 lux.

(b) Discuss in detail, using notes and ***freehand sketches***, **two** design considerations for a contemporary window frame and glazing system that will ensure the high thermal performance of both:

- the window frame ***and***
- the glazing system.

(c) Outline **two** environmental considerations that should be taken into account when recommending a preferred material for the window frame.

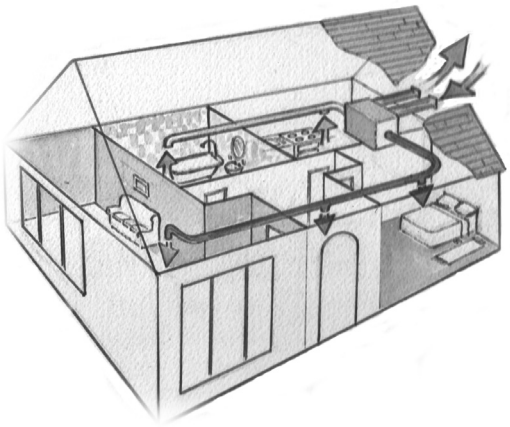
9. **(a)** Discuss in detail, using notes and ***freehand sketches,*** **three** functional requirements of an attic space suitable for use as a living area.

(b) The sketch shows the outline of an attic space in a new house. Identify **two** possible air leakage routes in the attic space. Using notes and ***freehand sketches,*** show clearly the correct design detailing that will improve the airtightness level at each air leakage route identified. Specify the materials used to achieve satisfactory airtightness levels.

(c) Discuss **two** advantages of improved airtightness in the attic space.

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:

- shape and form of the house
- continuity of insulation
- reduced thermal/cold bridging.



(b) The layout of a Mechanical Heat Recovery with Ventilation system (MHRV) for a Passive House is shown in the accompanying sketch. Explain, using notes and ***freehand sketches***, the operating principles of such a system and discuss **two** advantages of this system for a Passive House.

(c) Show, using notes and ***freehand sketches,*** **two** design details that would help prevent the possible overheating of a Passive House in summer.

OR

10. "In the increasingly urbanised world of the 21st century, a major challenge is to find solutions to the problems facing our towns and cities – the control of sprawl, sustainable growth, integrated transport systems and better-quality urban environments and public realms. Cities and towns that are diverse, varied in use, walkable, human scaled and identifiable by the high quality of their public realm can contribute to the process of creating sustainable urbanism. The challenge for all citizens is to make our towns and cities viable in the long term, environmentally and socially, as well as economically. There will be no sustainable world and no sustainable country without sustainable cities and towns".

Sustainable Urbanism: creating communities for the knowledge economy: by Anthony Reddy in ***The New Housing 2,*** **Royal Institute of Architects of Ireland 2009.**

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