



CIVIL TECHNOLOGY

Time: 3 hours

200 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 14 pages, a Formula Sheet and an Answer Booklet of 8 pages (i – viii). Please check that your question paper is complete.
2. This question paper consists of six questions.
3. Read all the questions carefully.
4. Answer all the questions.
5. Answer each question as a whole, do not separate sub questions.
6. Sketches may be used to illustrate your answer.
7. Use the mark allocation as a guide to the length of your answer.
8. Drawings and sketches must be done in pencil, fully dimensioned and neatly finished off with descriptive titles and notes to conform to the SANS/SABS Code of Practice for Building Drawing Practice (1043).
9. For the purpose of this paper, the size of a brick should be taken as 220 mm × 110 mm × 75 mm.
10. Use your own discretion where dimensions and/or details have been omitted.
11. Drawings in this paper are not to scale due to electronic transfer.

REQUIREMENTS:

1. Drawing instruments
 2. A non-programmable calculator
 3. Answer Booklet
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QUESTION 1 CONSTRUCTION, SAFETY AND MATERIAL**MULTIPLE CHOICE**

- 1.1 Various options are provided as possible answers to the questions. Choose the most correct answer, and in the Answer Book, write down the numbers, 1.1.1. – 1.1.5, below one another and next to the number, the most correct letter.
- 1.1.1 A hard hat will be used under the following circumstance:
- A when a person is laying tiles.
 - B when a person is welding two pieces of metal together.
 - C on a building site where large cranes are operated.
 - D while the plumber is installing taps in a finished bathroom. (1)
- 1.1.2 Eye protection is vital while a person is:
- A grinding metal.
 - B digging trenches for foundations.
 - C setting up a dumpy level.
 - D doing glazing on a window. (1)
- 1.1.3 Ear protection is important during the following operations:
- A mixing of concrete by hand.
 - B fixing electrical cables on a distribution board.
 - C laying roof tiles.
 - D compacting hard core fill with a plate compactor. (1)
- 1.1.4 Sturdy safety boots are used when a person is:
- A working in a metal factory.
 - B painting a roof.
 - C plastering a wall.
 - D fixing a ceiling. (1)
- 1.1.5 Safety gloves will be of importance when a person is:
- A inserting profile boards before digging trenches.
 - B working and passing bricks on a site.
 - C fixing kitchen cabinets.
 - D cutting rafters to length on a building site. (1)
- 1.2 Describe ONE safety precaution to be taken when working with the following portable power tools:
- 1.2.1 Portable circular saw. (1)
- 1.2.2 Portable angle grinder. (1)
- 1.2.3 Portable hand drill. (1)

1.3 FIGURE 1.3 below shows TWO different roofs, A and B, that can be used in the building industry.

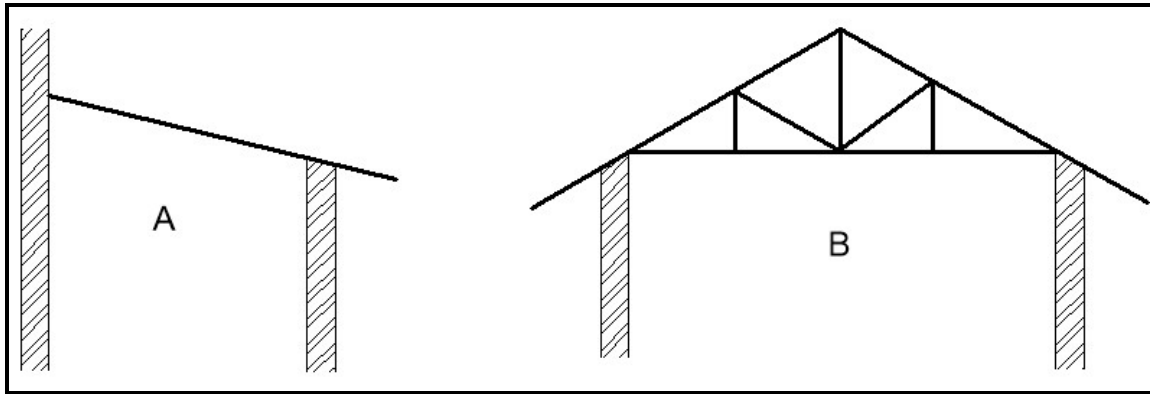


FIGURE 1.3

1.3.1 Identify roof trusses A and B and also state ONE specific type of building where they will be used. (4)

1.3.2 State ONE method that can be used to join rafters and tie beams together. (1)

1.4 Draw neatly TWO consecutive plan courses of a quoin (corner) of a wall built in English bond. Show clearly the following in your drawing:

- Headers
- Queen closers

NOTE: Proportion and line work (2)

Label the headers and queen closers (2)

Correctness of plan views 1 and 2 (4)

1.5 Explain the meaning of the following terminology used in the building trade:

1.5.1 Compaction of concrete (1)

1.5.2 Seasoning of timber (1)

1.5.3 Priming of metal (1)

1.6 Name ONE use of angle iron in building construction. (1)

1.7 Cladding is a term used when finishing a wall.

1.7.1 Define the term cladding. (1)

1.7.2 Name ONE material that can be used for cladding. (1)

1.8 During the construction process of a building, state ONE use of the following:

1.8.1 Roof ridge/Ridge (1)

1.8.2 Wall plate/rafter plate (1)

1.8.3 Lintel (1)

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QUESTION 2 ADVANCED CONSTRUCTION AND EQUIPMENT

2.1 Hand tools and portable power tools are constantly used on a building site.

Describe THREE ways to care for your power tools so that they can last longer. (3)

2.2 FIGURE 2.2 below shows THREE bars used in reinforcing. Write down the numbers 1 – 3 below one another in the Answer Book, and next to the number, identify the name of the specific bar used. (3)

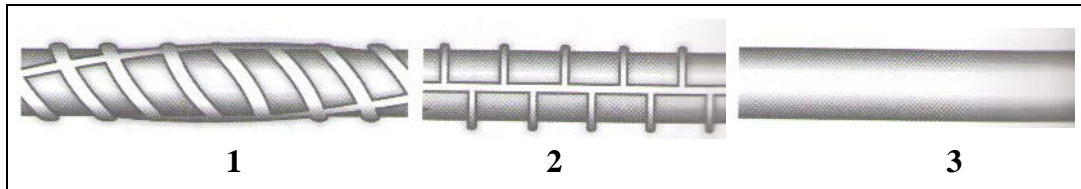


FIGURE 2.2

2.3 FIGURE 2.3 below shows methods A and B to insert pile foundation.

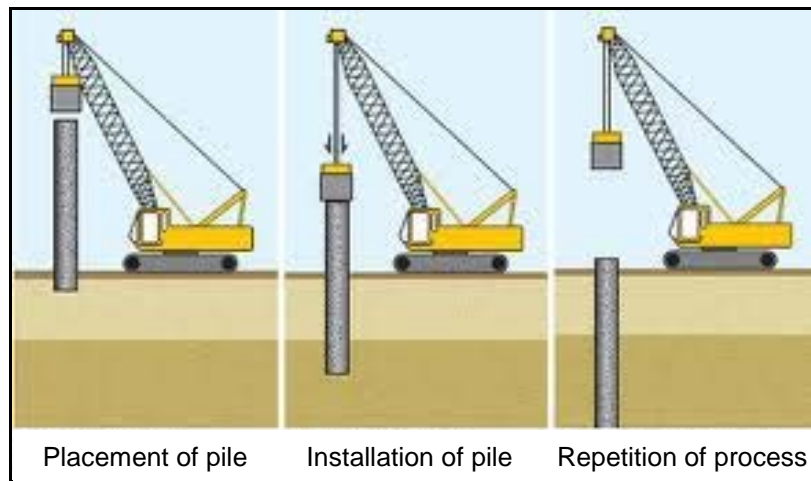


FIGURE 2.3 – Method A

[Source: <www.dutchfoundation.com>]

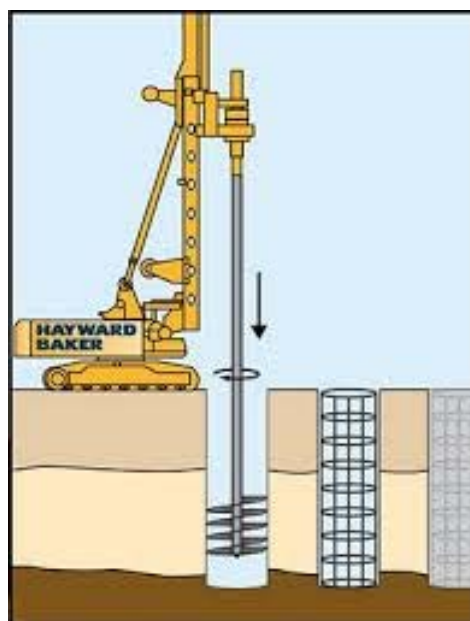


FIGURE 2.3 – Method B

[Source: <www.haywardbaker.com>]

2.3.1 Identify method A and state the type of soil where you would use this specific method to insert the pile. (2)

2.3.2 Identify method B and state the type of soil where you would use this specific method to insert the pile. (2)

2.4 FIGURE 2.4 below shows the vertical section through a concrete beam and floor with formwork and support structure for a first floor with certain labels excluded.

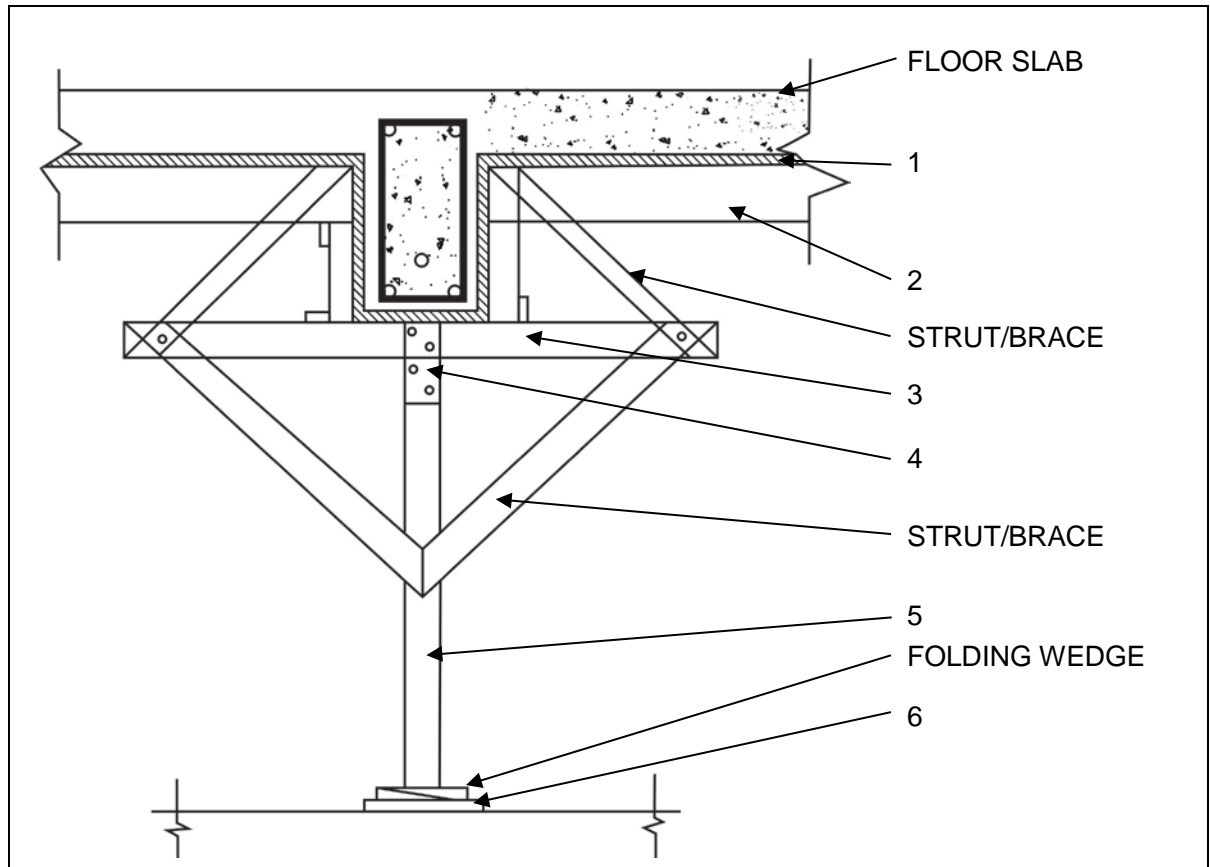


FIGURE 2.4

2.4.1 In the Answer Book, write down the numbers 1 – 6 below one another and next to the number, identify the relevant name for that part of the diagram. (6)

2.4.2 In the Answer Booklet, the incomplete cross section of the floor with the beam has been given. Finish the cross section by drawing the main bar, the anchor bar and the shear bar. The three bars drawn must be clearly labelled. (6)

2.5 FIGURE 2.5 shows a dumpy level on a site with different readings taken at specific points. Study the diagram and answer the following questions:

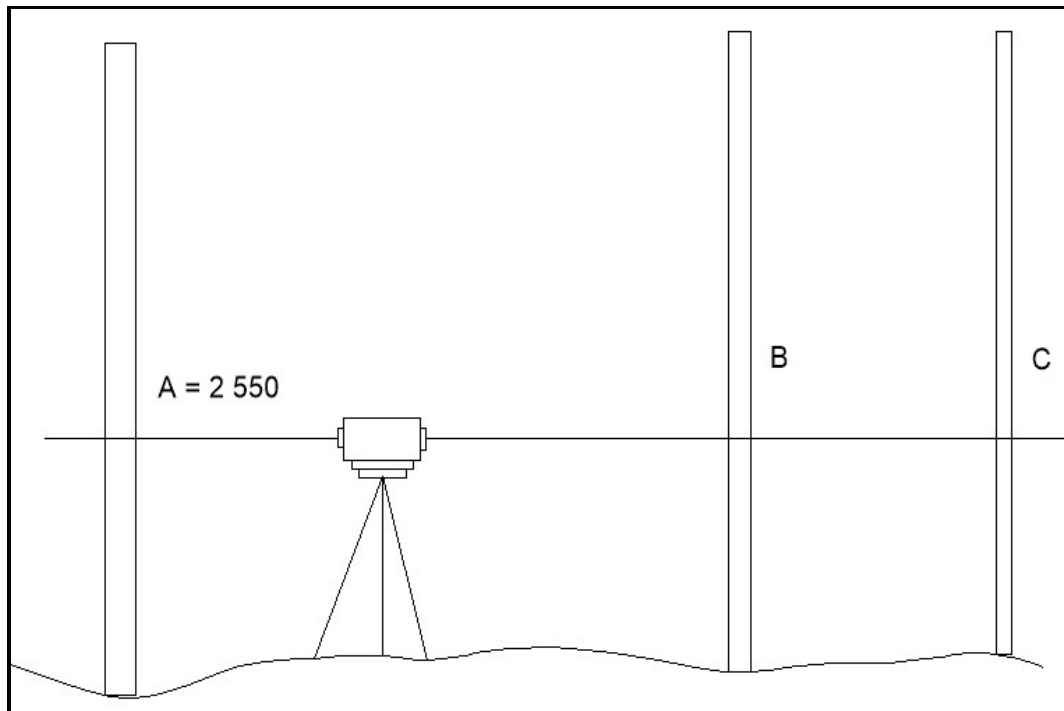


FIGURE 2.5

2.5.1 Draw what you will see through the eyepiece of the dumpy level when reading the telescopic staff at A. (4)

2.5.2 The reading at B on the staff is 2,350 and at C, it is 1,850. Calculate the horizontal distance difference between B and C, and state if there is a RISE or FALL from point B to C. (3)

2.6 The slump test is used for testing different characteristics of concrete.

2.6.1 State ONE reason for using the slump test. (1)

2.6.2 Name the piece of equipment that holds the concrete when doing the slump test. (1)

2.6.3 Draw a neat sketch of a shear slump and collapse that can occur during testing and identify the cause of this type of slump. (3)

2.7 You have been requested to order scaffolding for a building site that you work on.

2.7.1 Name TWO types of scaffolding that can be used on a building site. (2)

2.7.2 Describe ONE place where you would use the two scaffolds chosen in Question 2.7.1 above. (2)

2.8 Describe TWO advantages for using dry walls in the industry. (2)

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QUESTION 3 CIVIL SERVICES

3.1 Read the question carefully and choose the description from COLUMN B that matches an item in COLUMN A. Write down the numbers 3.1.1 – 3.1.5 below one another and next to it, the number of the corresponding letter.

COLUMN A	COLUMN B
3.1.1 Stratification in a geyser	A Main water pipe from the council to the gully
3.1.2 Submersible water pump	B A connection in a pipe that stops the flow of water
3.1.3 Water catchment area	C A pipe from the council that connects to the water metre
3.1.4 Pressure-reducing valve	D The characteristic of hot water rising
3.1.5 Communication pipe	E Used in a borehole, a way to get underground water to the surface
	F A connection in a pipe to maintain the correct water pressure in a certain fixture
	G Natural area where rainwater collects

(5)

3.2 Name the colour-coding used on a plumbing diagram to indicate the following:

3.2.1 Soil pipes (1)

3.2.2 Industrial waste (1)

3.2.3 Waste pipes (1)

3.3 FIGURE 3.3 in the Answer Booklet shows an incomplete floor plan of a basic single-room dwelling. On the Answer Booklet, draw the following SANS symbols for different components on the floor plan.

3.3.1 2 × Electrical switched socket outlets throughout the house. (2)

3.3.2 A double-tube fluorescent light in the kitchen area. (1)

3.3.3 A filament light in the bathroom and bedroom. (2)

3.3.4 A wall-mounted light outside the front door. (1)

3.3.5 Placement of a single-pole one-way switch and wiring for the bathroom. (2)

3.4 FIGURE 3.4 below shows a partial sectional sketch of the drainage system of a house. Study the sketch and answer the following questions:

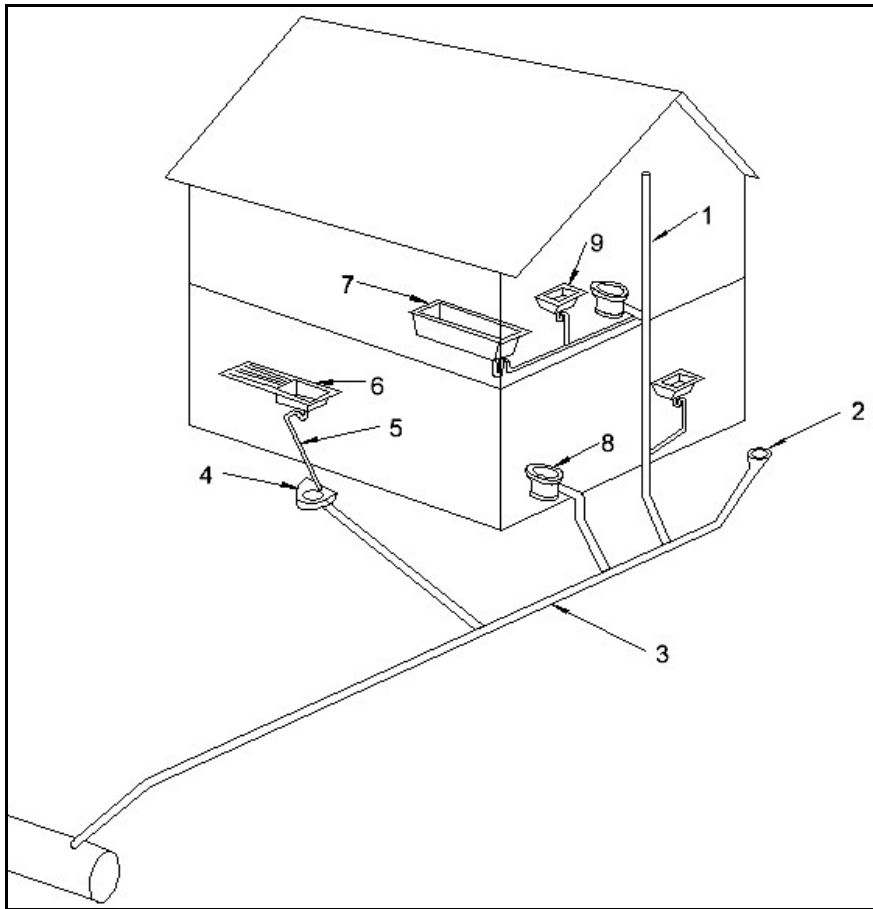


FIGURE 3.4

- 3.4.1 Write down the numbers 1 – 4 below one another and next to the number, identify the specific name for that part of the plumbing system. (4)
- 3.4.2 Name the diameter of part 3. (1)
- 3.4.3 Name the diameter of part 5. (1)
- 3.4.4 State the abbreviations used for fittings 6, 7 and 8. (3)
- 3.4.5 Draw the SANS symbol for fitting 8. (1)
- 3.4.6 Draw the SANS symbol for fitting 9. (1)
- 3.4.7 Describe TWO drainage principles that must be adhered to when designing a drainage system. (2)
- 3.4.8 Name ONE test that will be used to check for impediments in the drain pipe. (1)

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QUESTION 4 QUANTITIES, MATERIALS AND JOINING

4.1 State the name of the fastener (screw, hinge, glue, etc.) you would use for the following:

- 4.1.1 Joining a roof rafter to the wall plate. (1)
- 4.1.2 Joining a bathroom cabinet to a brick wall. (1)
- 4.1.3 Joining two PVC pipes together. (1)
- 4.1.4 Joining a purlin to a rafter. (1)
- 4.1.5 Joining the drywall to the noggin. (1)

4.2 FIGURE 4.2 shows a diagram for a raised four-panel external door. In your Answer Book, write down 4.2.1 – 4.2.7 below one another and next to the number, deduce from the diagram the missing detail for the specific part of the door on the cutting list given.

Description	Quantity	Length	Width	Thickness
4.2.1	2	1 980	4.2.2	45
Top Rail	4.2.3	712	4.2.4	4.2.5
Bottom Panel	4.2.6	630	652	4.2.7

(7)

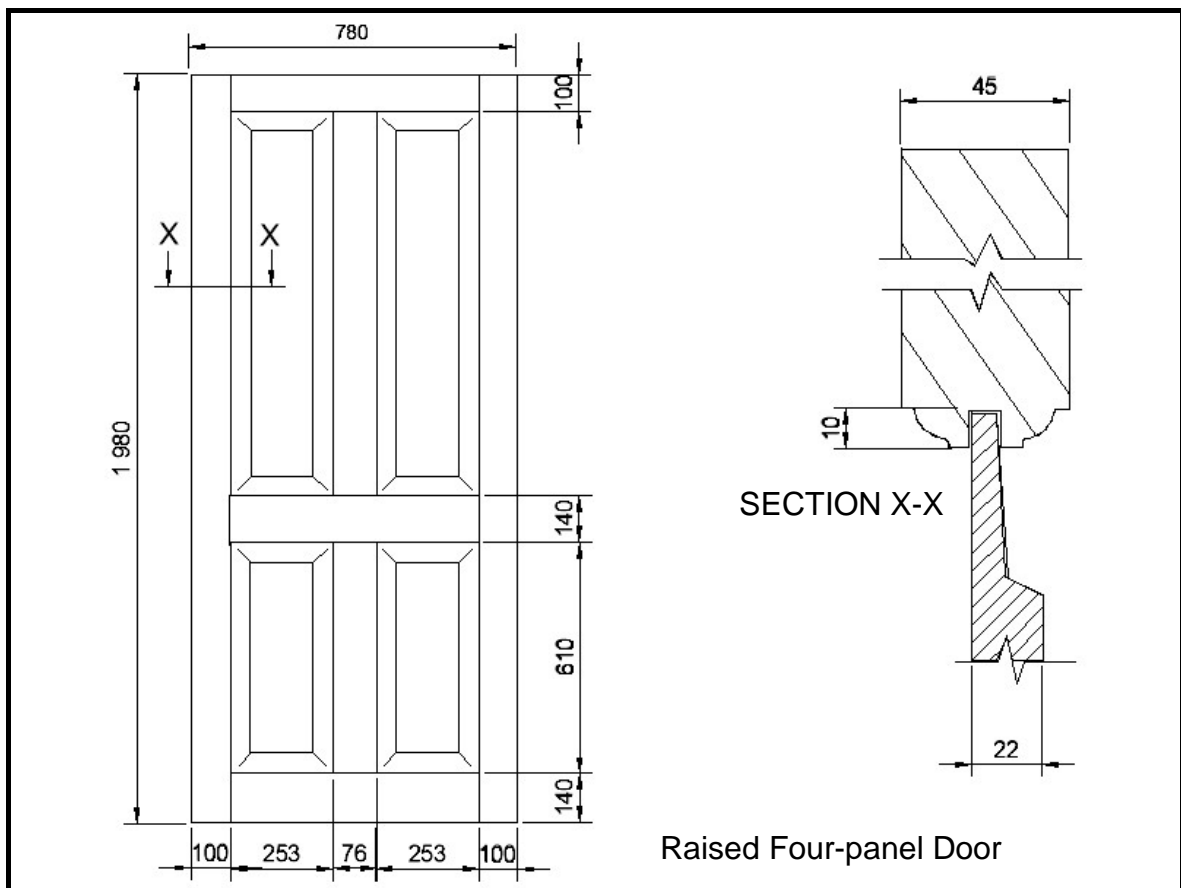


FIGURE 4.2

4.3 FIGURE 4.3 shows the front and sectional views of a wall. Use the four-column method in your Answer Booklet and calculate the following:

4.3.1 The total number of bricks required to build the wall. Take into account a 5% breakage of the bricks. (12)

4.3.2 You also want to cast a slab of concrete. The dimensions are 5 780 mm in length, 4 000 mm in width and 75 mm thick. You use a mix ratio of 2 cement : 4 sand : 4 stone. Calculate the volume of concrete required to throw the slab. (3)

4.3.3 Calculate the number of bags of cement you will buy if one bag of cement 50 kg = 0,015 m³. (3)

SPECIFICATIONS:

- **** Wall height = 2 700 mm
- **** Window W1 = 1 200 mm × 1 000 mm
- **** Window W2 = 1 200 mm × 800 mm
- **** Number of bricks = 52 bricks/m² for half-brick wall
- **** External wall = single brick/220 mm
- **** Breakage of bricks = 5%

** Round off your answer to TWO decimals.

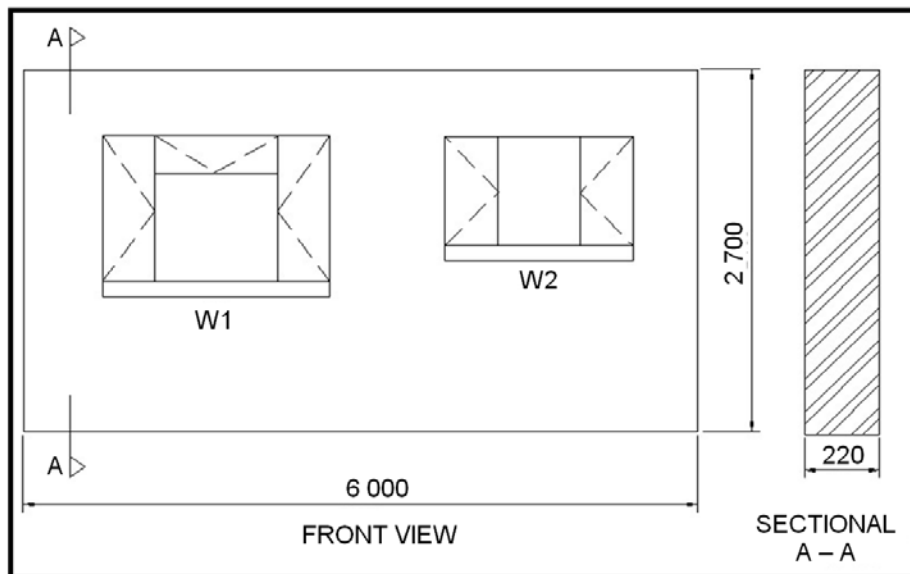


FIGURE 4.3

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QUESTION 5 APPLIED MECHANICS

5.1 FIGURE 5.1 below shows a figure of a lamina. Study the lamina and calculate the position of the centroid from axis A–A. All the measurements are in millimetres. (8)

** Round off your answers to TWO decimals.

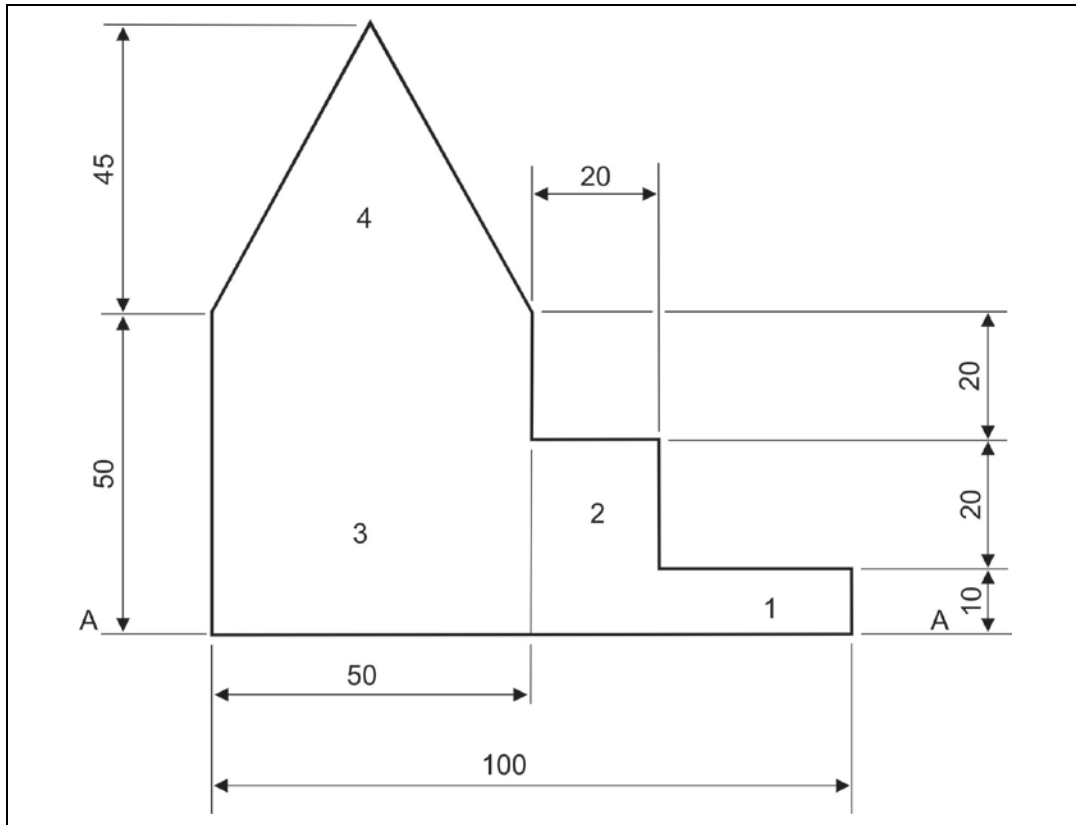


FIGURE 5.1

5.2 FIGURE 5.2 below shows the space diagram of a beam with a uniform distributed load and TWO point loads. Study the beam and answer the following questions:

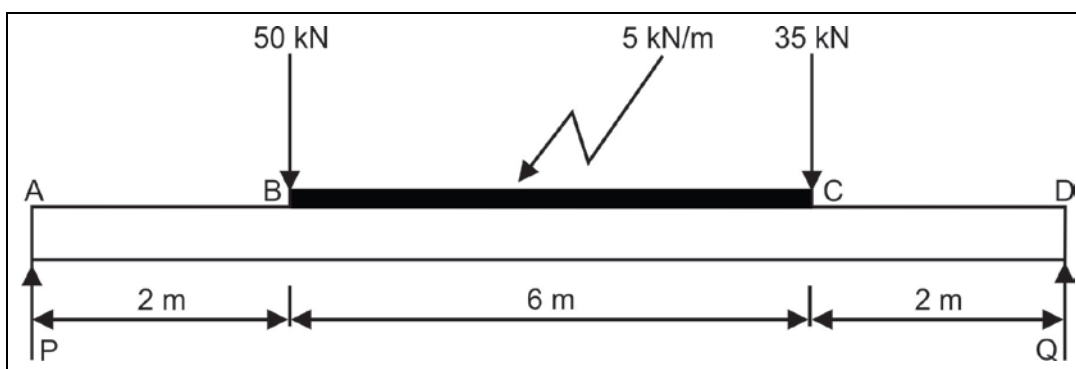


FIGURE 5.2

- 5.2.1 Calculate the reaction forces at P and Q. (4)
- 5.2.2 Calculate the bending moment at B and C from reaction point P. (6)
- 5.2.3 Show by means of calculation the shear force at B and C. (2)

5.3 FIGURE 5.3 below shows the space diagram of a framework.

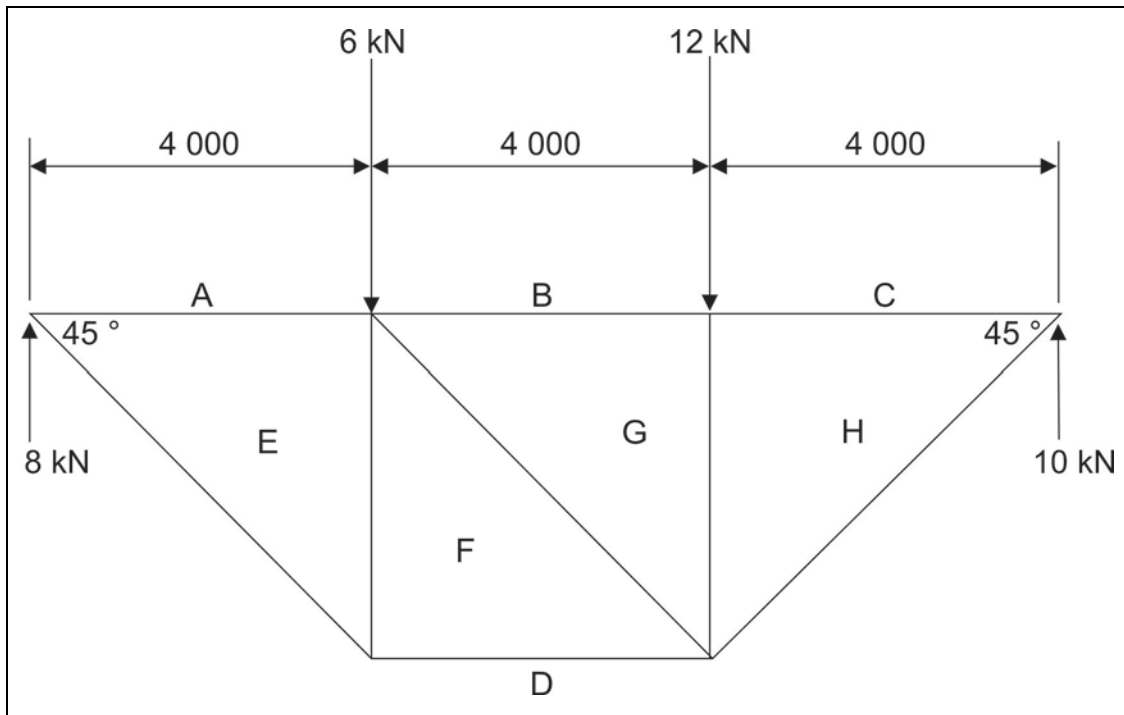


FIGURE 5.3

- 5.3.1 Develop and draw the vector diagram for the framework in the Answer Booklet. Scale 5 mm = 1 kN (6)
- 5.3.2 Refer to the vector diagram that you have done in Question 5.3.1 and complete the table in the Answer Booklet. Deduce from the space and vector diagram the nature and magnitude for the specific members of the framework as indicated in the table. (4)

MEMBER	NATURE	MAGNITUDE
GF	A	2,8 kN
DE	B	11,2 kN
BG	Strut	C
HD	Tie	D

[30]

QUESTION 6 GRAPHIC COMMUNICATION

6.1 FIGURE 6.1 IN THE ANSWER BOOKLET shows comprehensive drawings of a small dwelling. Study the drawings and answer the questions on the table in the Answer Booklet. (15)

6.2 FIGURE 6.2 below (see on page 14) shows the floor plan of a dwelling.

6.2.1 In the Answer Booklet, Question 6.2, draw to scale 1:50 the SECTIONAL VIEW C-C.

Do NOT show the rest of the house. Only draw the sectional view slightly past the king post. NO roof covering, purlins, battens, ceilings, cornices, fascia or sectional detail of window are to be drawn. (19)

6.2.2 Show, by means of the correct dimensioning method, the dimensions of the foundation. (2)

6.2.3 Indicate the following labels on the drawing:

- Scale
 - Title of drawing
 - FFL
 - NGL
- (4)

Specifications:

- The foundation is 600 mm × 200 mm.
- The thickness of the external wall is 220 mm.
- The height between the top of the foundation and the natural ground level is 300 mm.
- The height of the super structure is 2 700 mm.
- Height between the natural ground level and the top of the floor slab is 300 mm.
- The floor slab is 100 mm thick and extends 110 mm into the exterior wall.
- The door opening is 2 100 mm high and 900 mm wide.
- The height of the windows is 1 500 mm.
- The width of the lintels is 110 mm and the height is 75 mm.
- The window sills inside and outside are to be shown.
- The building has a gable roof with a pitch of 30°.
- The roof is a SA Truss with one queen post.
- The wall plate is 114 mm × 38 mm.
- All the members of the roof are 114 mm × 38 mm.
- The eaves overhang is 500 mm.

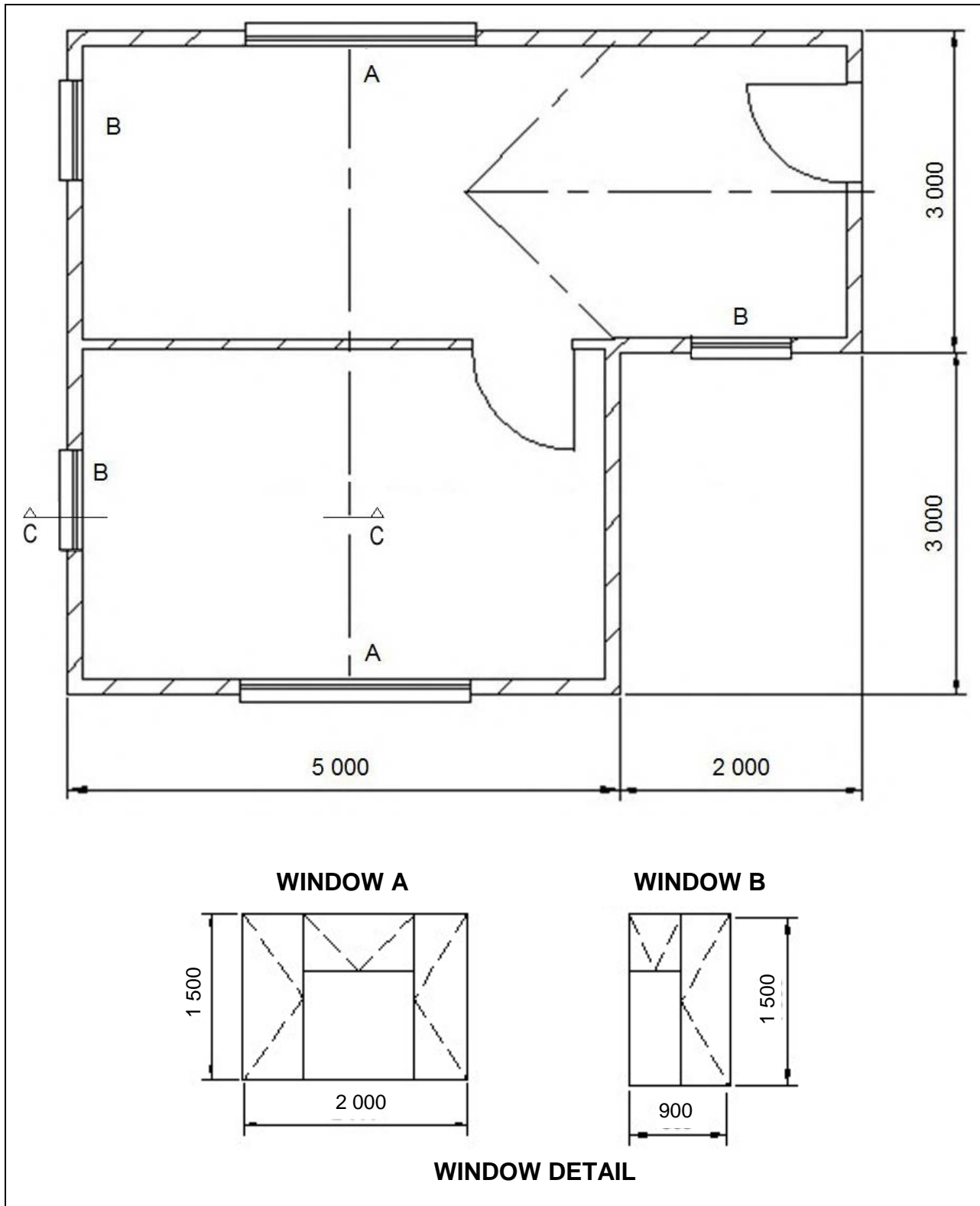


FIGURE 6.2

[40]

Total: 200 marks