



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**CIVIL TECHNOLOGY
FEBRUARY/MARCH 2009**

MARKS: 200

TIME: 3 hours

This question paper consists of 14 pages, 7 answer sheets and 1 formula sheet.

REQUIREMENTS

1. Answer book
2. Drawing instruments
3. A non-programmable pocket calculator

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions.
2. ALL questions are COMPULSORY.
3. Answer each question as a whole, do NOT separate sub-questions.
4. Start EACH question on a NEW page.
5. Answer QUESTIONS 2.7, 3.2, 4.5, 5.2.1, 5.2.2, 6.1, 6.2 and 6.3 on the attached ANSWER SHEETS, using drawing instruments where necessary. Write your examination number on ALL the ANSWER SHEETS and hand them in with your ANSWER BOOK. (Place ALL the answer sheets inside the front cover of the ANSWER BOOK.)
6. Sketches may be used to illustrate your answers.
7. ALL calculations and written answers must be done in the ANSWER BOOK.
8. Use the mark allocation as a guide to the length of your answer.
9. Where applicable, drawings and sketches must be fully dimensioned and neatly finished off with descriptive titles and notes to conform to the *SANS/SABS Recommended Practice for Building Drawings*.
10. For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.
11. Use your discretion where dimensions and/or details have been omitted.
12. Non-programmable pocket calculators may be used.

QUESTION 1: CONSTRUCTION PROCESSES

- 1.1 What provision must be made in the brickwork to anchor roof trusses securely before the superstructure reaches wall plate level? (1)
- 1.2 Write down the regulations specifying the anchoring of:
- 1.2.1 Light-weight roofs (1)
- 1.2.2 Heavy-weight roofs (1)
- 1.3 What fasteners can be used to secure corrugated iron roof sheeting to the purlins? (1)
- 1.4 Explain why it is important to brace roof trusses. (4)
- 1.5 Write down the size (cross-sectional measurements) of the following:
- 1.5.1 A purlin that will be used to secure galvanised roof sheeting (1)
- 1.5.2 A batten that will be used to secure cement roof tiles (1)
- 1.6 You are required to erect a steel structure on site. List THREE safety items that you must be wearing whilst erecting the structure. (3)
- 1.7 As a Grade 12 learner of Civil Technology you will soon exit the formal schooling system. You do not wish to further your studies but wish to join the labour force in the building industry. You can enter the building industry by becoming an apprentice. Name FOUR trades in which you can serve as an apprentice in this industry. (4)
- 1.8 South Africa is hosting the 2010 World Cup Soccer tournament. Many provinces are busy building stadiums and therefore a lot of concrete is being used. Stone is a major component of concrete and it is obtained by blasting at quarries. Name and describe TWO effects that blasting will have on the environment and the community living close to the quarry. (4)
- 1.9 Scaffolding is a valuable asset to workmen on site.
- 1.9.1 Define the term *scaffolding*. (2)
- 1.9.2 What part of a scaffold will prevent the scaffold from sinking into the ground when it is placed on a soft surface? (1)
- 1.9.3 How can a scaffold be made mobile on site? (1)
- 1.9.4 Name TWO types of scaffolds. (2)

- 1.10 You are a cabinet maker constructing a bathroom cabinet with a centrally fitted shelf.

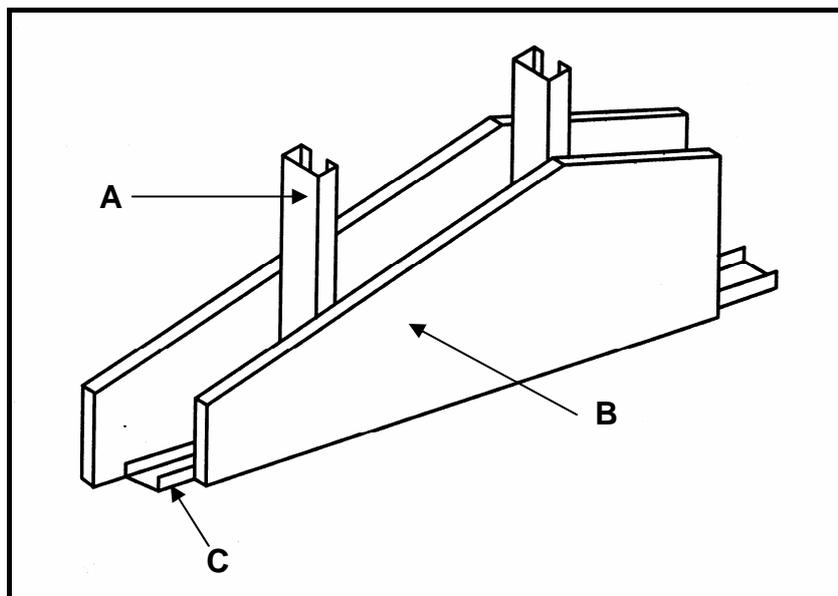
Show, by means of a three-dimensional freehand sketch, an exploded view of any ONE of the following woodwork joints that can be used to join the sides to the shelf: (Indicate the name of the joint that you draw on your drawing.)

- Through housing
- Stopped dovetail housing
- Double stopped housing
- Through dovetail housing
- Stopped housing
- Barefaced dovetail housing

(3)
[30]

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

- 2.1 Gusset plates are commonly used in steel constructions.
- 2.1.1 What will a gusset plate be used for in steel constructions? (1)
- 2.1.2 Name TWO joining methods that can be used to join gusset plates to other members of a structure. (2)
- 2.2 Different types of foundations can be used in construction; pile foundation is one of them.
- 2.2.1 What do you understand by the term *pile foundation*? (1)
- 2.2.2 Where will you use a pile foundation? (2)
- 2.3 Rib and block suspended floors are popular in the building industry.
- 2.3.1 List FOUR advantages that rib and block suspended floors have over a solid reinforced concrete floor slab. (4)
- 2.3.2 If you had to install a rib and block floor, list THREE materials that you would require. (3)
- 2.4 FIGURE 2.4 below illustrates an isometric drawing through the construction detail of a dry wall system. Write down the letters A – C in the ANSWER BOOK and write the correct name of each member next to each letter. (3)

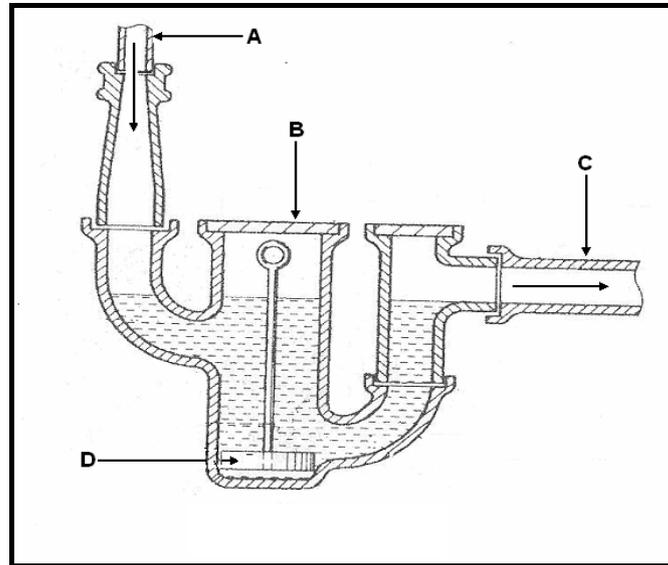
**FIGURE 2.4**

(3)

- 2.5 When is it necessary to do underpinning on a building? (2)
- 2.6 Many modern homes have high concrete columns as features to the building. Reinforcement plays a crucial role in these columns. Make a neat sketch of a horizontal section through a circular column to show the necessary reinforcement within it.
- Use the following specifications:
- (i) The column is reinforced with 6 main bars with a diameter of 16 mm
 - (ii) Use a helical binder
 - (iii) Indicate the minimum concrete cover
- (8)
- 2.7 The figure on ANSWER SHEET 2.7 (attached) illustrates a vertical section through a basement.
- Complete the figure ON the ANSWER SHEET by inserting the damp-proof course (DPC) to make the basement waterproof. (4)
- 2.8 You are applying for a job as a bricklayer. During your interview you are asked to pack TWO consecutive plan layers of a T-junction built in a one-brick wall in English bond, with a stopped end on the one side, to illustrate your competency.
- Make a neat two-dimensional drawing in the ANSWER BOOK to show these TWO consecutive plan layers of a T-junction built in a one-brick wall in English bond, with a stopped end on the one side. (10)
- [40]**

QUESTION 3: CIVIL SERVICES

- 3.1 FIGURE 3.1 illustrates a grease trap installed in the waste-water systems of hotels, restaurants and hostels.

**FIGURE 3.1**

- 3.1.1 Write down the letters A – D in the ANSWER BOOK and write the correct name of each member, as shown in FIGURE 3.1, next to each letter. (4)
- 3.1.2 Briefly explain how you would maintain the trap illustrated in FIGURE 3.1, to prevent blockages. (2)
- 3.2 FIGURE 3.2 on ANSWER SHEET 3.2 illustrates plumbing fittings installed in a house.
- 3.2.1 Complete the figure ON the ANSWER SHEET by inserting the piping system for the hot- and cold-water supply. Use single lines to indicate the pipe work. Differentiate between the hot-water pipes (short dashed lines) and cold-water pipes (solid lines). (8)
- 3.2.2 What is the purpose of the stopcock as indicated on the figure on ANSWER SHEET 3.2? (2)
- 3.3 South Africa is experiencing a shortage of electricity supply to the community. The government is trying to find an alternative supply of electricity. There are many alternatives and nuclear power is one option.
- 3.3.1 What is *nuclear power*? (1)
- 3.3.2 Does South Africa have a nuclear power plant that generates electricity? (1)

- 3.4 Describe, in your own words, what you understand by the term *hydro electricity*. (2)
- 3.5 A conservancy tank is an alternative method of removing waste-water and sewage from a property.
- 3.5.1 Name TWO instances when it becomes necessary to install a conservancy tank. (2)
- 3.5.2 Explain the process used to empty a conservancy tank. (4)
- 3.6 You are living in a rural area and do not have piped water, but get your water from a nearby river. List FOUR ways in which the water you consume (drink), could be polluted. (4)
- [30]**

QUESTION 4: MATERIALS

- 4.1 Choose a material from COLUMN B that matches a product in COLUMN A. Write only the letter (A – H) next to the question number (4.1.1 – 4.1.6) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Manhole covers	A	stainless steel
4.1.2	Damp-proof course	B	copper
4.1.3	Water conduit/pipes	C	cement fibre (asbestos)
4.1.4	Washing troughs	D	brass
4.1.5	Roof sheeting	E	plastic
4.1.6	Waste pipes	F	mild steel
		G	cast iron
		H	PVC

(6 x 1) (6)

- 4.2 As a builder, it is important when mixing mortar/concrete to get the proportion of water right so that the water is adequate. The amount of water used in concrete plays a very important part.

What is the role of water in a concrete mixture? (2)

- 4.3 A contractor has just placed the concrete of the foundation. He should then ensure that the concrete has been fully compacted.

4.3.1 What do you understand by *compaction of concrete*? (3)

4.3.2 Various methods are used to compact concrete. Name TWO of these methods. (2)

- 4.4 When reinforcing concrete the bars should be completely covered by concrete.

What can happen to the reinforcing bars if the concrete cover is not thick enough? (2)

- 4.5 FIGURE 4.5 represents the front elevation of a one-room farm school with the following specifications: (Answer this question on ANSWER SHEET 4.5.)

SPECIFICATIONS:

Dimensions of front elevation – the building is 10 m wide and 3 m high.

Door – 1 m wide and 2 m high.

Window – 2 m wide and 1,5 m high.

100 bricks cover an area of 1 m² for a one-brick wall. The walls of the superstructure are one brick thick (220 mm).

The building is fitted with a lean-to roof with parapet walls, sloping from the front to the back.

- 4.5.1 What is the total area of the openings (doors and windows) for the front wall as shown in FIGURE 4.5? Show ALL calculations. (3)
- 4.5.2 Determine the total area of the brickwork for the front wall as shown in FIGURE 4.5. Show ALL calculations. (6)
- 4.5.3 Determine the total number of bricks required to build the wall for the front elevation illustrated below. (3)

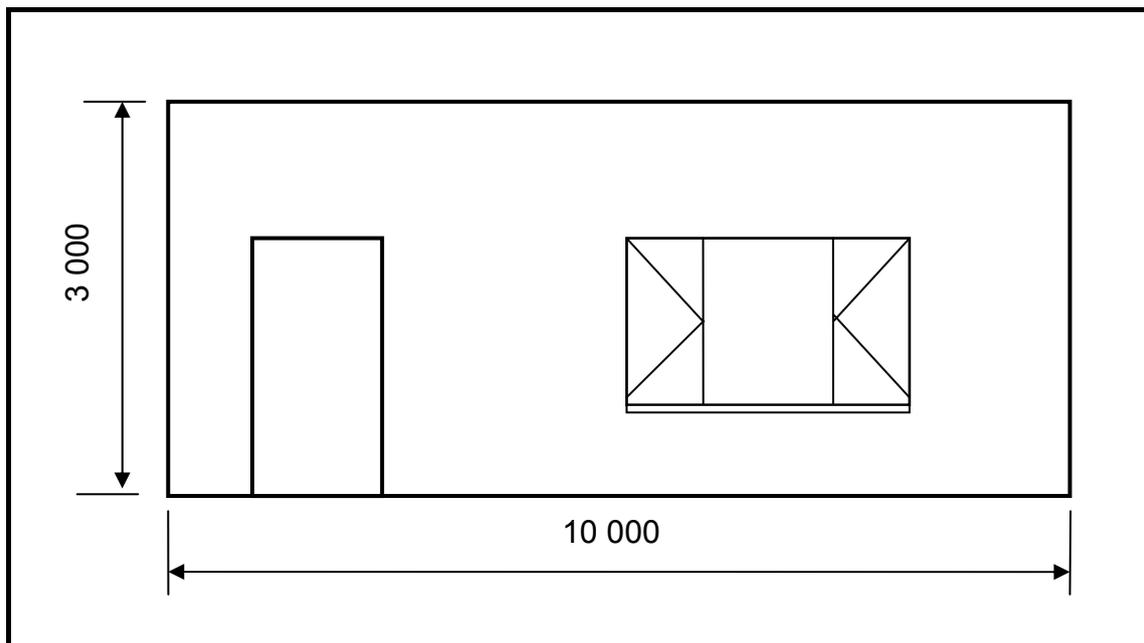
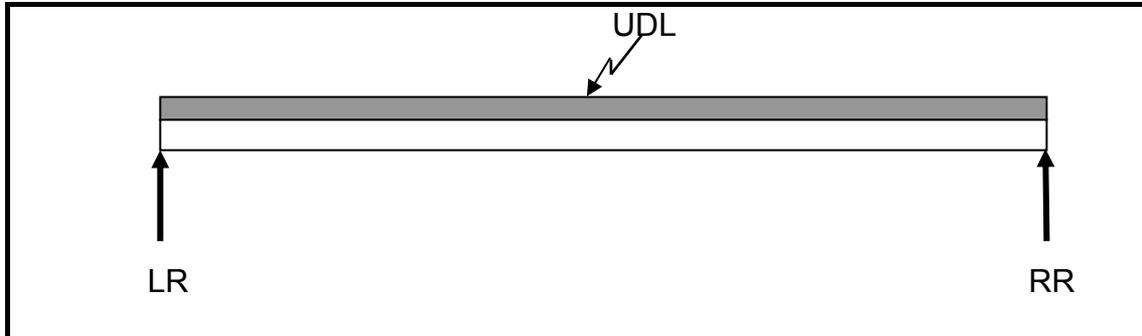


FIGURE 4.5

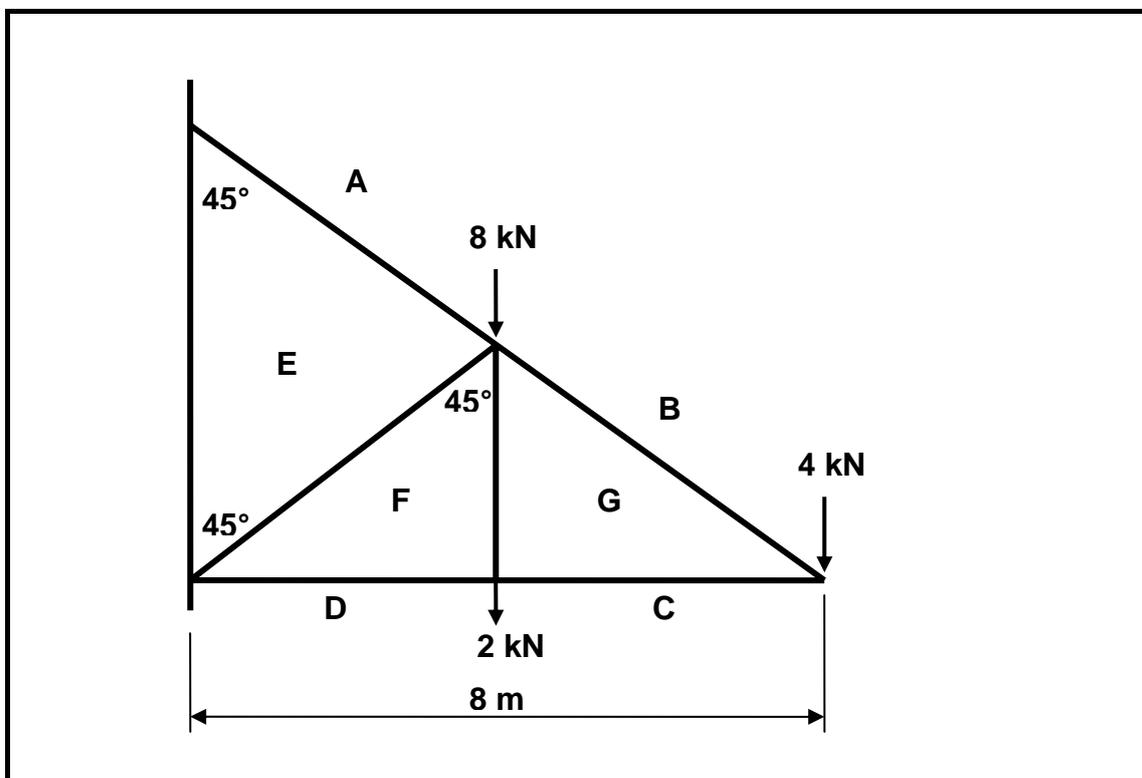
- 4.5.4 Calculate the total price of the bricks needed if the price for 1 000 bricks is R1 200,00. (3)
- [30]**

QUESTION 5: APPLIED MECHANICS

- 5.1 FIGURE 5.1 shows a simply supported beam with a uniformly distributed load spread across the entire beam.

**FIGURE 5.1**

- 5.1.1 What do you understand by the term *uniformly distributed load*? (1)
- 5.1.2 Determine the magnitude of the UDL on the beam if the span of the beam indicated in FIGURE 5.1 is 8 m, and the left reaction (LR) and the right reaction (RR) are 48 N each. Indicate your answer in N/m. (4)
- 5.2 FIGURE 5.2 below shows the space diagram of a cantilever roof truss that has to be placed on a newly built structure.

**FIGURE 5.2**

- 5.2.1 Use ANSWER SHEET 5.2.1 and determine graphically the magnitude and nature of each member of the roof truss as shown in FIGURE 5.2.

Use a scale of 10 mm = 1 kN.

(6)

- 5.2.2 Use the information in QUESTION 5.2.1 to complete the table below on ANSWER SHEET 5.2.2.

MEMBER	MAGNITUDE	NATURE
AE		
BG		
CG		
DF		
EF		
FG		

(12)

- 5.3 FIGURE 5.3 shows a lamina that is of a uniform thickness, with a square hole in the lamina. Calculate the centroid of the lamina from line A-B as shown in the figure.

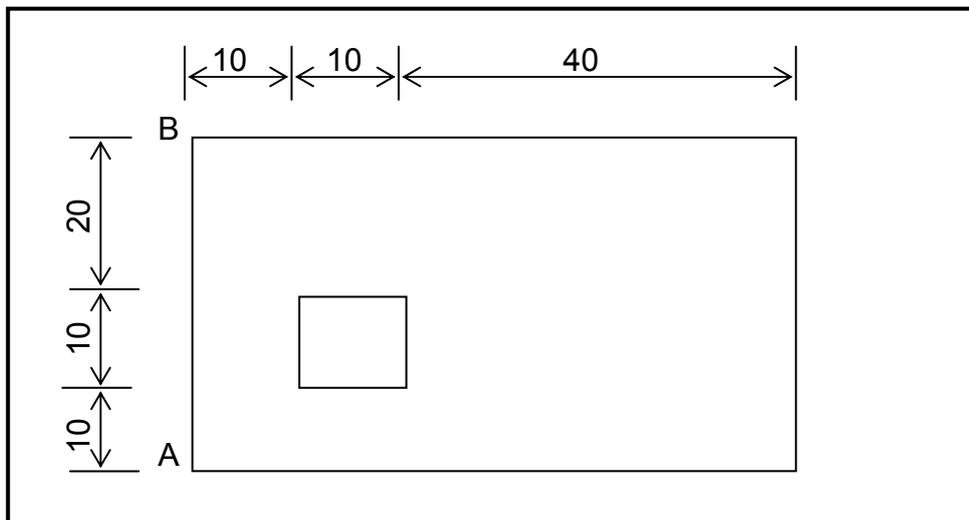


FIGURE 5.3

(7)
[30]

QUESTION 6: GRAPHICS AND COMMUNICATION

Answer this question on the attached ANSWER SHEETS.

You need to build a garage for your father to park his new car at your house. As an aspiring draughtsman you are required to produce the working drawings for this garage. The garage is NOT attached to the main building.

NOTES:

- The entrance to the garage is a roll-up door.
- The entrance to the garage must be south-facing and a ramp must be built to allow access for a vehicle.
- The structure is built with 220 mm x 110 mm x 75 mm face bricks.
- The roof is a king post roof with a pitch of 30°.

6.1 Using a scale of 1:50, design and draw the floor plan of the garage required in the top half of ANSWER SHEET 6.1. Dimension the length and width of the building.

Use the following specifications:

- Internal measurements of the garage – 6 000 mm x 3 000 mm
- Garage-door opening – 2 400 mm wide x 2 100 mm high (south-facing)
- Windows – Window 1(W1) – 1 500 mm wide x 900 mm high (east-facing)
- Window 2 (W2) – 2 000 mm wide x 600 mm high (west-facing) (10)

6.2 Draw to scale 1:50 the west elevation of the garage in the bottom half of ANSWER SHEET 6.1.

Use the following specifications:

- Internal measurements of the garage – 6 000 mm x 3 000 mm.
- The finished floor level is 150 mm above the natural ground level.
- The walls are 2 700 mm high measured from the floor to the underside of the wall plate.
- Windows – Window 1(W1) – 1 500 mm wide x 900 mm high (east-facing).
Window 2 (W2) – 2 000 mm wide x 600 mm high (west-facing).
- Roof: Pitch 30° with an overhang of 600 mm on the eastern and western sides of the building and 200 mm on the gable ends.
- Corrugated iron sheeting is used for the roof covering.
- The roof is finished with 100 mm diameter gutters and down pipes. (10)

- 6.3 Insert a section line A-A on the floor plan 1 metre from and parallel to the northern wall. On ANSWER SHEET 6.3, draw to scale 1:20 a vertical section through the garage on section line A-A as seen from the southern side. Do NOT section a door or window. Draw just more than half of the width of the section. (It is NOT necessary to label the drawing.)

Use the following specifications:

- Roof:
 - Pitch 30° with an overhang of 600 mm on the east and west side of the building and 200 mm on the gable ends
 - Corrugated iron sheeting is used for the roof covering
 - Rafters – 114 mm x 38 mm
 - Purlins – 76 mm x 50 mm
 - Wall plate – 114 mm x 38 mm
 - 100 mm diameter gutter and down pipes
- Internal measurements of the garage: 6 000 mm x 3 000 mm
- The walls are 2 700 mm high measured from the floor to the underside of the wall plate
- Sub-structure – Concrete foundation – 600 mm x 220 mm
Natural ground level (NGL) is 500 mm from the bottom of the foundation
Hardcore filling – 150 mm thick
Concrete floor – 75 mm thick
DPC

(20)
[40]

TOTAL: 200

EXAMINATION NUMBER

ANSWER SHEET 2.7

QUESTION 2.7

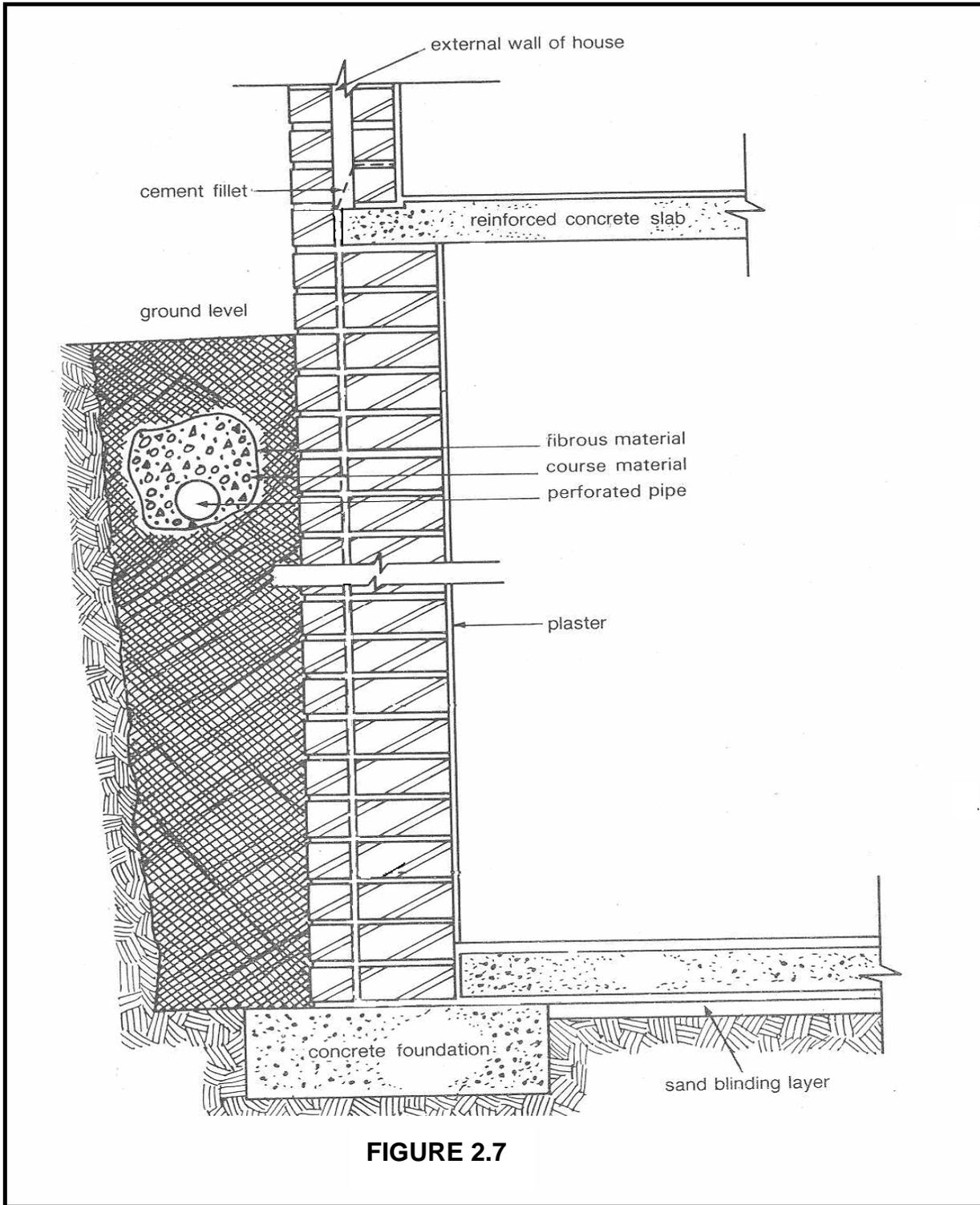


FIGURE 2.7

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ANSWER SHEET 3.2

QUESTION 3.2

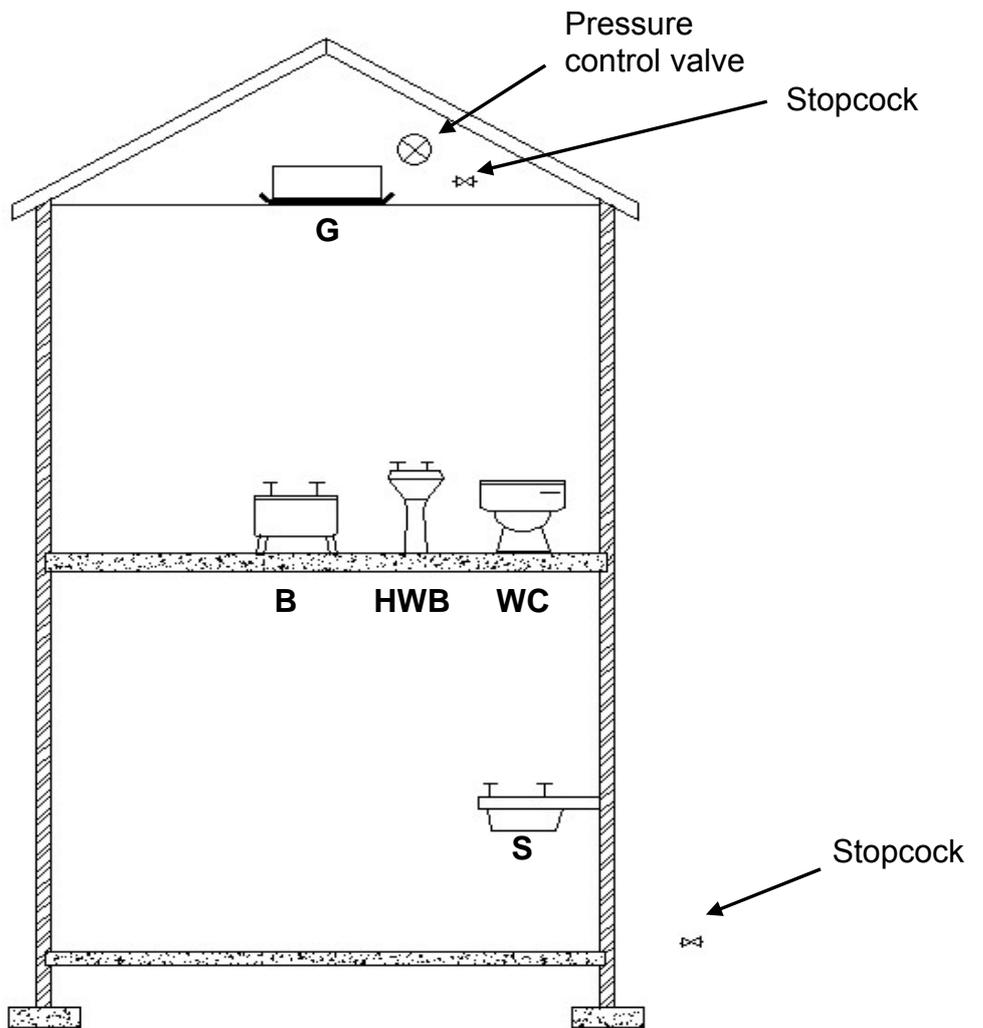


FIGURE 3.2

(8)

EXAMINATION NUMBER														
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ANSWER SHEET 5.2.1

QUESTION 5.2.1

a |

EXAMINATION NUMBER														
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ANSWER SHEET 5.2.2**QUESTION 5.2.2**

MEMBER	MAGNITUDE	NATURE
AE		
BG		
CG		
DF		
EF		
FG		

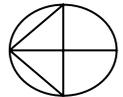
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ANSWER SHEET 6.1

QUESTION 6.1

FLOOR PLAN

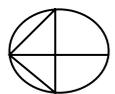


(10)

ANSWER SHEET 6.2

QUESTION 6.2

ELEVATION



(10)

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ANSWER SHEET 6.3

QUESTION 6.3

FORMULA SHEET

IMPORTANT ABBREVIATIONS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
G	Centre of gravity	h	Height	d	Diameter
C	Centroid	b	Breadth/Width	r	Radius
L	Length	s	Side	A	Area
Π	$\text{Pi} = \frac{22}{7} = 3,142$	\emptyset	Diameter	V	Volume

FORMULAE

AREA OF	FORMULA (in words)	FORMULA (in symbols)	FORMULA FOR THE POSITION OF CENTROIDS	
			X-axis	Y-axis
Square	Length x Breadth	$l \times b$	$\frac{b}{2}$	$\frac{b}{2}$
Rectangle	Length x Breadth	$l \times b$	$\frac{l}{2}$	$\frac{b}{2}$
Right-angled triangle	$\frac{1}{2} \times \text{base} \times \text{height}$	$\frac{1}{2}b \times h$	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/Pyramid	$\frac{1}{2} \times \text{base} \times \text{height}$	$\frac{1}{2}b \times h$	$\frac{b}{2}$	$\frac{h}{3}$
Circle	$\Pi \times \text{radius} \times \text{radius}$	Πr^2	Centroid is in the centre	
Circle	$\Pi \times \text{diameter} \times \text{diameter divided by 4}$	$\frac{\Pi d^2}{4}$		
Semi-circle	$\Pi \times \text{radius} \times \text{radius divided by 2}$	$\frac{\Pi r^2}{2}$	Centroid is 0,424r on the centre line	

$$\text{Position of centroid} = \frac{(A1 \times d) + /- (A2 \times d)}{\text{Total area}}$$