basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

CIVIL TECHNOLOGY

FEBRUARY/MARCH 2011

MARKS: 200

TIME: 3 hours

This question paper consists of 14 pages, 6 answer sheets and a formula sheet.

REQUIREMENTS

1.   Drawing instruments

2.   A non-programmable pocket calculator

3.   ANSWER BOOK

INSTRUCTIONS AND INFORMATION

1.   This question paper consists of SIX questions.

2.   Answer ALL the questions.

3.   Answer each question as a whole, do NOT separate subquestions.

4.   Start EACH question on a NEW page.

5.   Sketches may be used to illustrate your answers.

6.   ALL calculations and written answers must be done in the ANSWER BOOK or on the attached ANSWER SHEETS.

7.   Use the mark allocation as a guide to the length of your answers.

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 Recommended Code of Practice for Building Drawings.

9.   For the purpose of this question paper, the size of a brick should be taken as 220 mm x 110 mm x 75 mm.

10.   Use your discretion where dimensions and/or details have been omitted.

11.   Non-programmable pocket calculators may be used.

12.   Answer QUESTIONS 2.7, 3.1, 4.1, 5.1, 6.1 and 6.2 on the attached ANSWER SHEETS using drawing instruments where necessary.

13.   Write your centre number and examination number on every ANSWER SHEET and hand them in with your ANSWER BOOK, whether you have used them or not.

14.   Drawings in the question paper are not to scale due to electronic transfer.

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QUESTION 1: CONSTRUCTION PROCESSES

1.1   You have to mix concrete for a slump test by hand. Name TWO items of protective equipment that can be used and give reasons why you will use them to protect yourself from cement dust and wet concrete.   (4)

1.2   You are a carpenter and joiner on site and are required to install a door into a door frame. One of the tools you will use is a portable power plane. Name TWO safety precautions you will observe while using the power plane.   (2)

1.3   Explain why it is essential to have minimum concrete cover over steel reinforcement in concrete structures.   (2)

1.4   This question is based on the design of a gusset plate. Give ONE word for each of the following descriptions:

    1.4.1   Distance between the centres of the bolts   (1)

    1.4.2   Distance from the centre of a bolt to the end of a member (edge of a gusset plate)   (1)

    1.4.3   The line along the length of a steel member, for example an angle iron, on which holes must be drilled to connect a gusset plate   (1)

1.5   Bolts and nuts or welding can be used for joining steel members when manufacturing steel roof trusses. Choose ONE of the given options that you will recommend for the joining of steel members and motivate your choice.   (2)

1.6   In formwork for columns yokes are used to keep the four sides together. Explain why the distance between the yokes increases as one moves higher up the formwork.   (2)

1.7   Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question number (1.7.1 – 1.7.5) in the ANSWER BOOK, for example 1.7.6 D.

    1.7.1   Folding wedges are used to …

        A   separate timber.
        B   stabilise wheelbarrows.
        C   join pieces of timbers.
        D   secure struts under formworks.   (1)

    1.7.2   A wall plate sometimes requires lengthening. The most suitable joint to use would be a …

        A   lapped joint.
        B   dovetail joint.
        C   bridle joint.
        D   mortise and tenon joint.   (1)

1.7.3 Which ONE of the following nails will be the most suitable to fix ceiling boards onto ceiling battens (brandering)?

A Wire nail
B Panel pin
C Escutcheon pin
D Clout nail (1)

1.7.4 Before casting concrete, formwork is coated with mould oil. The purpose of this is to …

A stop the concrete from adhering to the formwork.
B keep the aggregates together.
C retard the setting of the concrete.
D stop the formwork from rotting. (1)

1.7.5 The purpose of installing cornices under ceilings is to…

A strengthen the ceiling.
B provide a level line to skim the ceiling.
C cover joints between ceiling boards.
D close the gap between the wall and ceiling. (1)

1.8 FIGURE 1.8 below shows a line diagram of a South African roof truss. Draw a neat, two-dimensional freehand sketch of the ridge construction of the truss in good proportion (the part in the circle).

Your drawing must show the following details:

- Part of the rafters
- Purlin
- Ridging (ridge capping)
- Galvanised roof sheeting
- Part of the king post
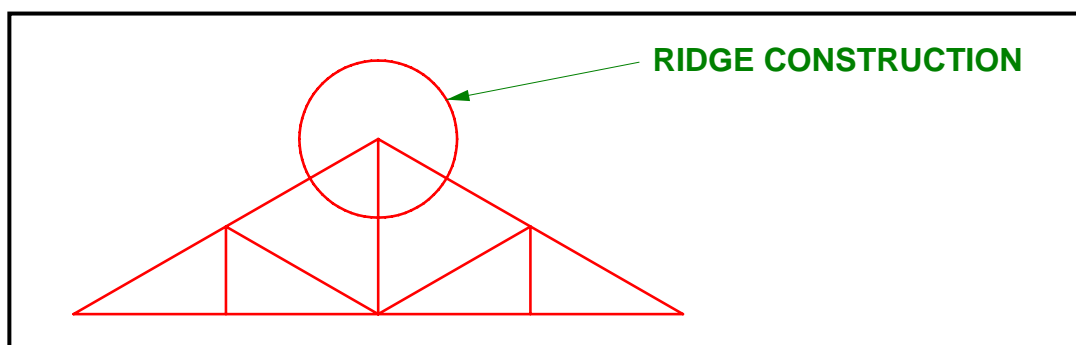- All the labels above on your sketch

FIGURE 1.8 (10)
[30]

QUESTION 2: ADVANCED CONSTRUCTION PROCESSES

2.1   Distinguish between a *rough arch* and a *gauged arch*.   (2)

2.2   Draw a neat, two-dimensional freehand sketch of a sectional view of an L-shaped reinforced concrete column. Show EIGHT main bars and the applicable binders. Label your drawing.   (6)

2.3   Formwork for columns consists of a vertical mould or box which resists pressure in the early stages of casting the concrete.

       FIGURE 2.3 below shows the formwork for a square reinforced concrete column. Write down A – F in your ANSWER BOOK and next to it the names of the parts. Choose your answers from the list below.

┌──┐
│   yoke; clamp; concrete; bolts; formwork boards; wedge; bearers; │
│   joists; flat bar   │
└──┘

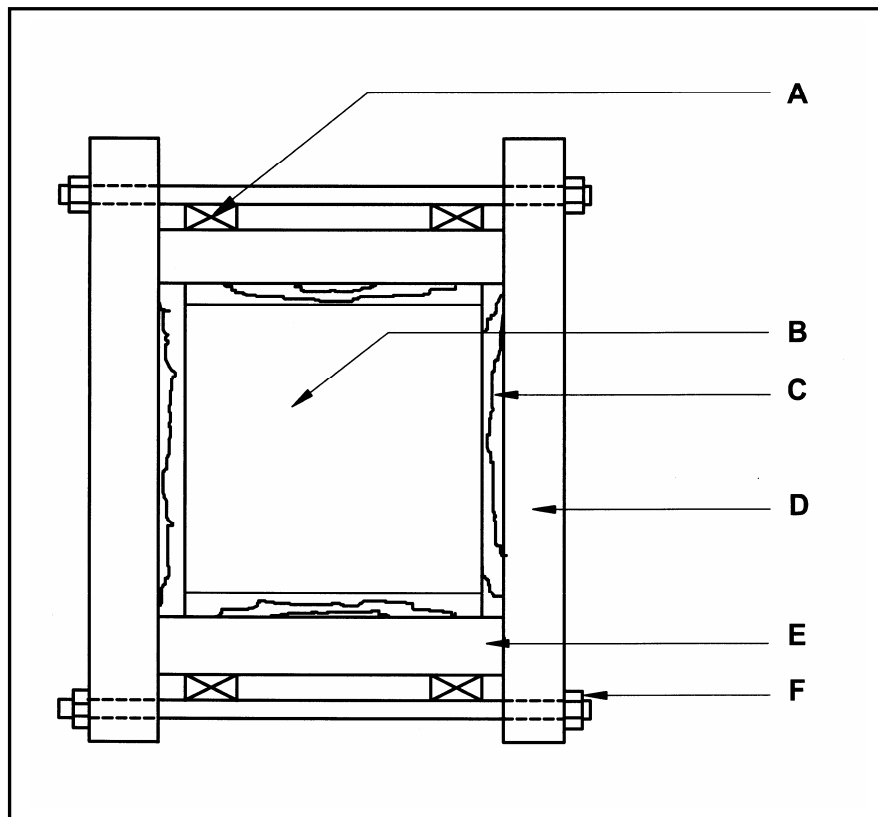**FIGURE 2.3**   (6)

2.4   Name TWO different types of measurements that can be taken with a dumpy level.   (2)

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2.5   FIGURE 2.5 below shows two readings (**A** and **B**) as seen through the eyepiece of a dumpy level. Calculate the reading at **C**.

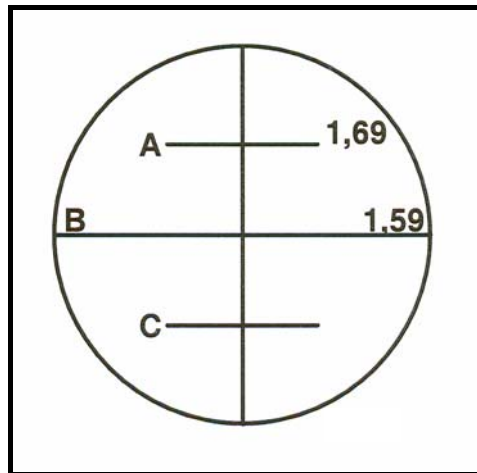

FIGURE 2.5   (3)

2.6   Rearrange the steps (A – E) below for the setting up of a dumpy level in the correct sequence. Write only the letters of the correct steps in your ANSWER BOOK.

A.   The telescope is placed parallel to two of the foot screws. The air bubble is centred using these two screws.

B.   The telescope is turned back through the same quadrant to return it to the first position. If no adjustments have to be made, the instrument is ready for use.

C.   When the air bubble is central to the telescope, turn the telescope clockwise through 90° to lie over the third screw. Again the air bubble is centred but using only the third screw.

D.   Set up the tripod as level as possible.

E.   Fix the instrument on the tripod.   (5)

2.7   The top view of one course of a cross junction of a half-brick wide wall, in stretcher bond, (not to scale) is shown on ANSWER SHEET 2.7. Use the plan course on ANSWER SHEET 2.7 to project and draw the consecutive plan course. Provide your drawing with a title.   (10)

2.8   Identify FOUR factors that must be taken into account during the planning stage of a rib and block floor.   (4)

2.9   Explain under which conditions piled foundations will be used.   (2)

[40]

QUESTION 3: CIVIL SERVICES

3.1   FIGURE 3.1 on ANSWER SHEET 3.1 shows the plan of a kitchen, toilet and bathroom.

3.1.1   Use ANSWER SHEET 3.1 and design an appropriate sewerage plan for this building. Label your drawing.   (10)

3.1.2   Show the abbreviations for each of the sanitary fitments on ANSWER SHEET 3.1.   (5)

3.2   Boreholes is an alternative form of water supply.

3.2.1   Name TWO advantages of a borehole.   (2)

3.2.2   Name TWO disadvantages of a borehole.   (2)

3.3   Name TWO advantages of using windmills for the generation of electricity in a rural area.   (2)

3.4   Explain what you understand by *hydro-electricity*.   (2)

3.5   Identify the FOUR main components of a conventional hydro-electric power station.   (4)

3.6   Name the inclination angle for an installed solar collector.   (1)

3.7   Think about your own school and suggest TWO ways in which electricity consumption can be reduced.   (2)

[30]

QUESTION 4: MATERIALS AND QUANTITIES

4.1   You are a carpenter and have to make TEN roof trusses for a home that is
        being built.

        FIGURE 4.1 below shows the elevation of a South African roof truss. The
        length of each member is shown in the table below the drawing.
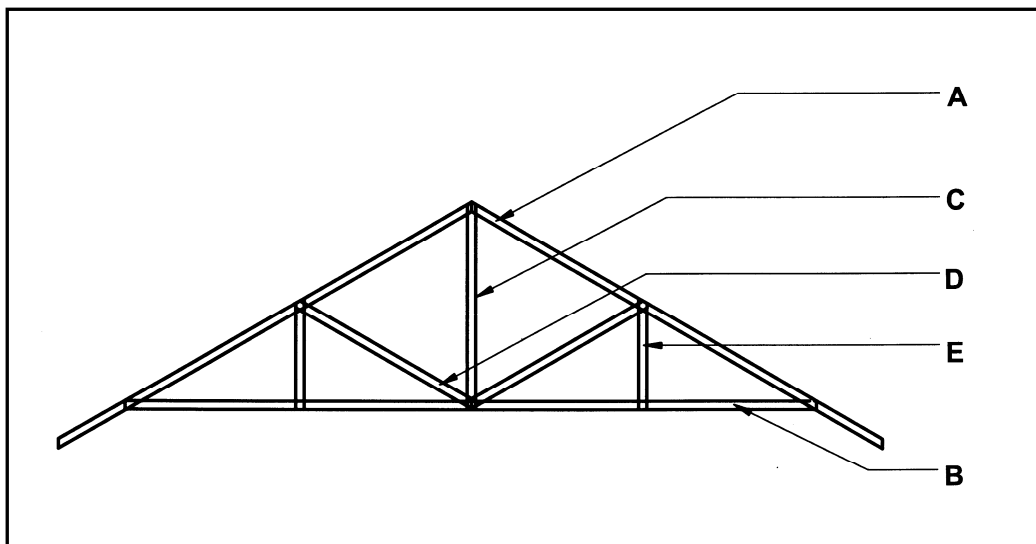

FIGURE 4.1

LENGTH OF MEMBERS:

PART NO.	LENGTH
A – Rafter	6 420 mm
B – Tie beam	4 400 mm
C – King post	2 100 mm
D – Strut	1 850 mm
E – Queen post	1 550 mm

        Answer QUESTIONS 4.1.1 and 4.1.2 on ANSWER SHEET 4.1.

4.1.1   Use the measurements for each member marked A – E in
        FIGURE 4.1 above and calculate the amount of material required
        to make TEN trusses. Use the measurements given above and do
        not make provision for trimming.

        NOTE: Calculate material for TEN trusses.   (12)

4.1.2   If the timber is only available in 6 metre lengths, calculate the
        number of lengths that must be purchased.   (3)

4.2   Timber for roof trusses must be treated. Give TWO reasons why it must be
        treated.   (2)

4.3   A slump test is done on freshly mixed concrete.

    4.3.1   Explain the purpose of a slump test.   (1)

    4.3.2   FIGURE 4.3.2 below shows the outcomes of three slump tests. Analyse the drawings and identify the type of slump in **A**, **B** and **C**.
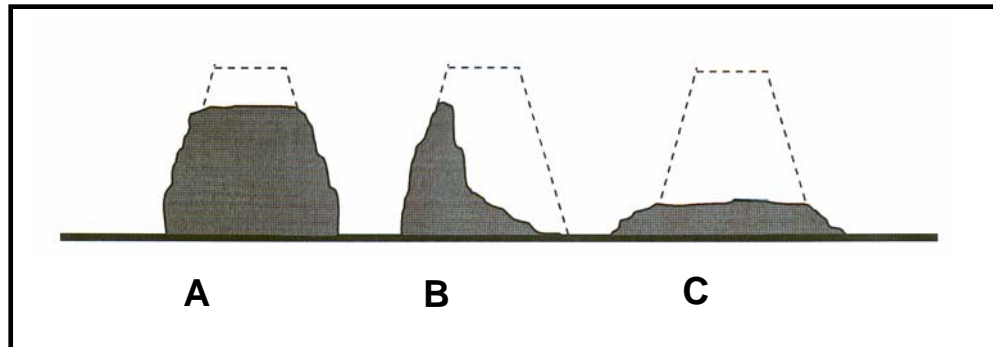

FIGURE 4.3.2   (3)

    4.3.3   Name TWO items that form part of a slump test apparatus.   (2)

4.4   Explain the effect that corrosion has on steel.   (1)

4.5   Describe how a steel roof truss can be protected from corrosion.   (2)

4.6   Calculate the volume of concrete for a foundation trench measuring 3 metres long, 600 mm wide and 200 mm deep.

    Use the following formula:

    Volume = length x breadth x depth   (4)

[30]

QUESTION 5: APPLIED MECHANICS

5.1   FIGURE 5.1 below shows the space diagram of a cantilever roof truss.
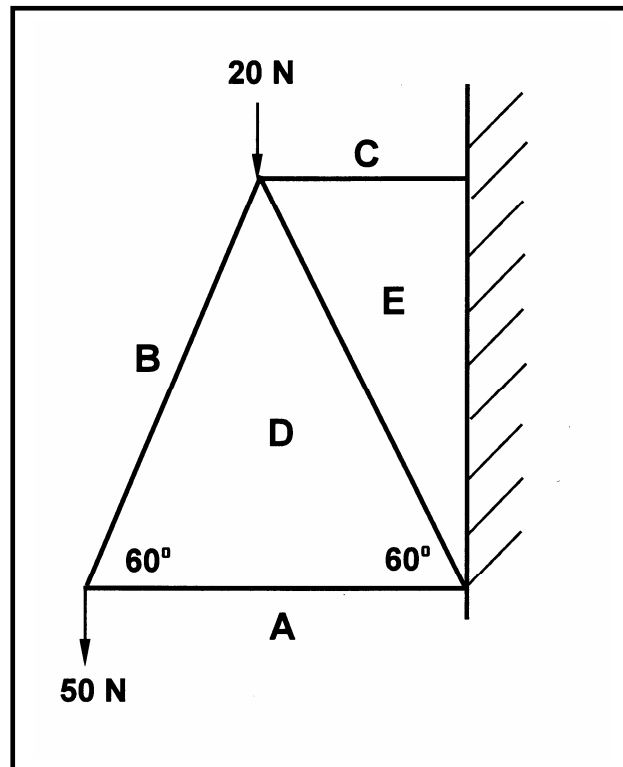
FIGURE 5.1

5.1.1   Use ANSWER SHEET 5.1 and develop a vector diagram to determine graphically the magnitude and nature of the forces in each member (part) of the truss. Use scale 1 mm = 1 N.   (4)

5.1.2   Show the nature of the forces on the space diagram on ANSWER SHEET 5.1.   (1)

5.1.3   Use the information from the space and vector diagrams and complete the table on ANSWER SHEET 5.1.   (8)

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5.2   FIGURE 5.2 below shows the lamina of a figure with a triangular hole in it. All measurements are in mm.

FIGURE 5.2

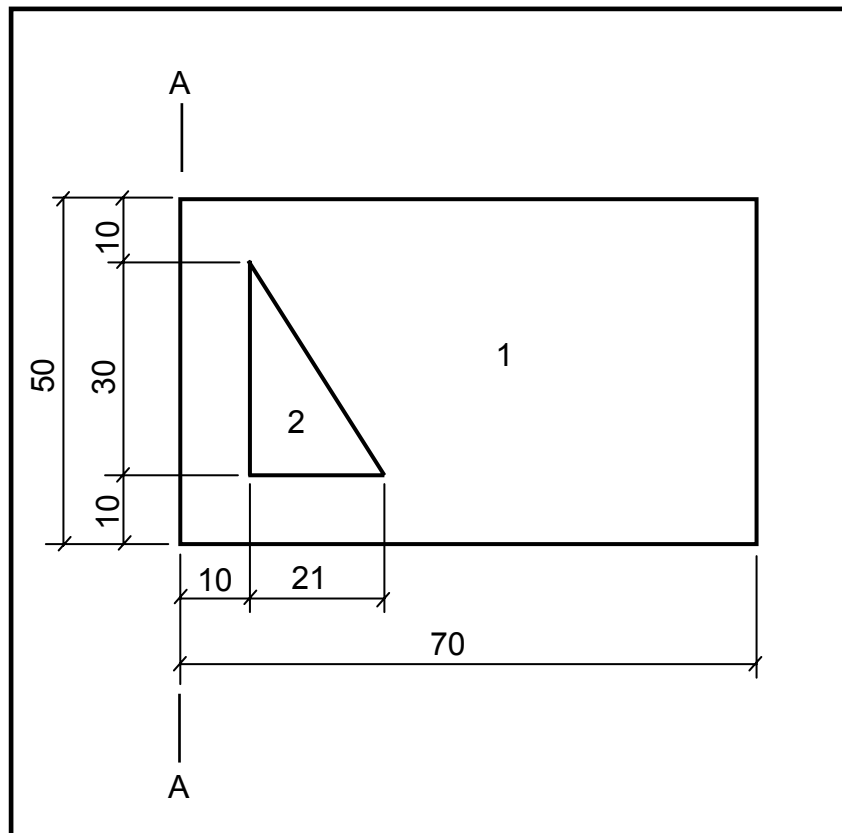5.2.1   Calculate the total area of the lamina.   (6)

5.2.2   Calculate the position of the centroid from A-A. Round off your answer to TWO decimals. Indicate the unit in your answer.   (8)

5.3   A square bar 50 mm x 50 mm, with a length of 800 mm, increases in length by 0,4 mm when subjected to a load of 2 200 N. Calculate the strain (deformation) of the bar.   (3)

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QUESTION 6: GRAPHIC COMMUNICATION

6.1   FIGURE 6.1 below illustrates the site plan of a proposed dwelling. Analyse the drawing and complete the table on ANSWER SHEET 6.1.

FIGURE 6.1   (15)

6.2 FIGURE 6.2 below shows the floor plan of a proposed building. Use the given specifications to develop and draw to scale 1 : 50 on ANSWER SHEET 6.2 the south elevation of the building.

FIGURE 6.2

SPECIFICATIONS:

- The door is 2 000 mm high and 900 mm wide.
- The roof is covered with galvanised sheeting and is finished with 220 mm wide fascia boards.
- Rain-water pipes are 75 mm in diameter and 100 mm square gutters are used.
- The height between the top level of the floor slab and the underside of the wall plate is 2 600 mm.
- The height between the natural ground level and the top level of the floor slab is 300 mm.
- The eaves overhang is 450 mm.
- The roof overhang on the gable end is 200 mm.
- The door step is 150 mm high.
- The building has a gable roof with a pitch of 30°.

Show the following on your drawing:

- The method of determining the roof height
- Window sills (18)

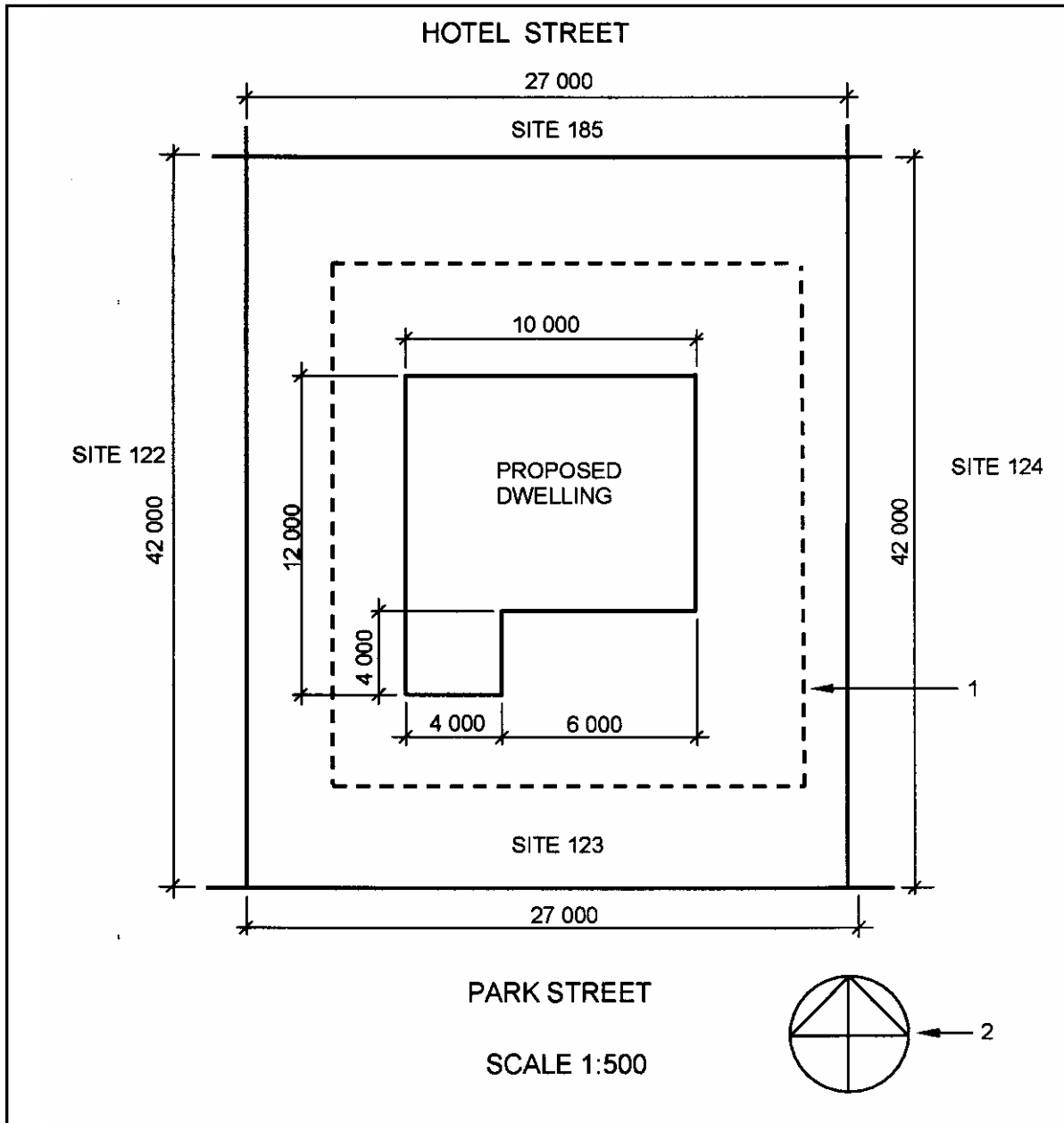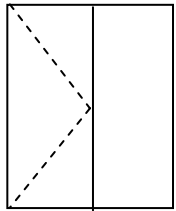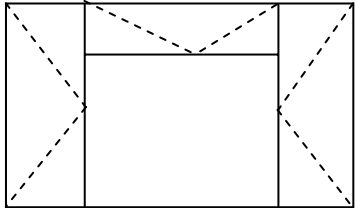Show the following labels on your drawing:

- Natural ground level (NGL)   (1)
- Floor level (FL)   (1)
- Type of wall finishing   (1)
- Roof pitch   (1)
- Roof covering   (1)
- Title   (1)
- Scale   (1)

WINDOW SCHEDULE			
WINDOW 1 (W 1)		WINDOW 2 (W 2)	
WIDTH	HEIGHT	WIDTH	HEIGHT
1 000	1 500	2 000	1 500

[40]

TOTAL: 200

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 2.7

ANSWER SHEET 2.7

(10)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 3.1

ANSWER SHEET 3.1

CONNECTION TO
CONSERVANCY TANK
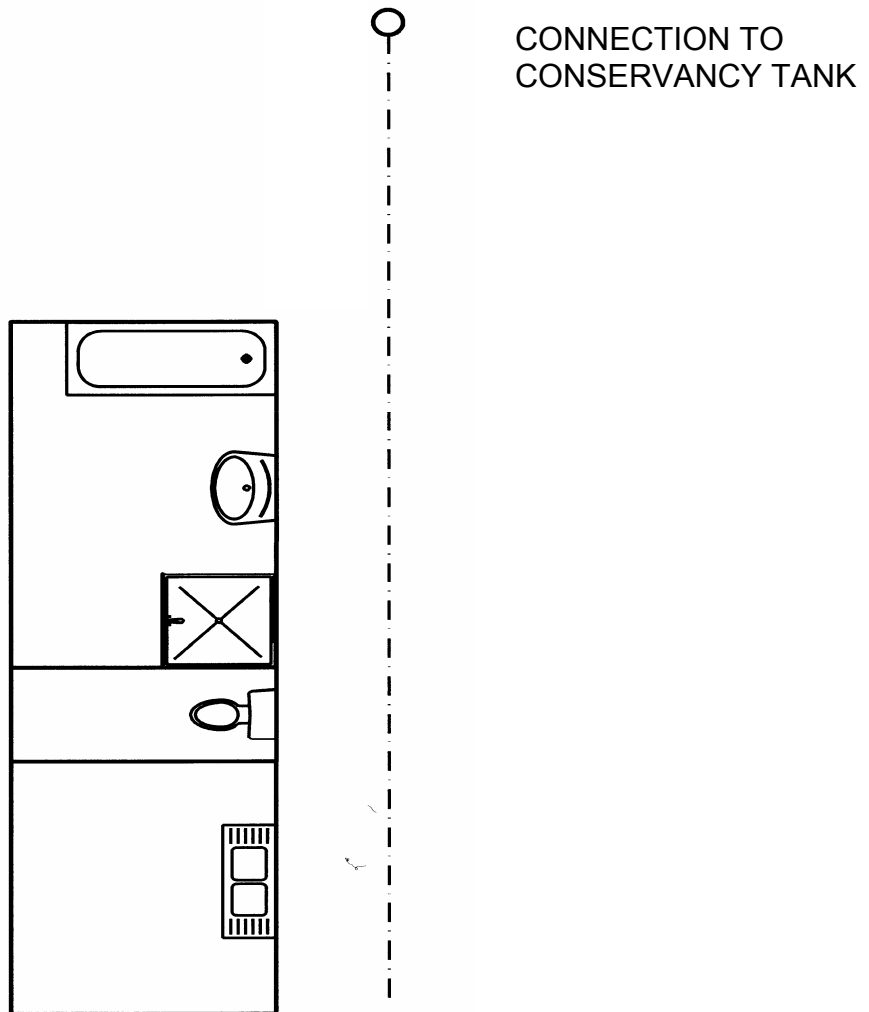
FIGURE 3.1

MARK ALLOCATION		
RE	1	
IE	3	
VP	1	
G	1	
Correct line type	1	
Description of pipe	3	
Sanitary fixtures	5	
TOTAL	15	

(15)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 4.1

ANSWER SHEET 4.1

4.1.1

DESCRIPTION	NO. REQUIRED	LENGTH	WIDTH	THICKNESS	SUBTOTAL LENGTH REQUIRED
A – RAFTER		6 420 mm	114 mm	38 mm	
B – TIE BEAM		4 400 mm	114 mm	38 mm	
C – KING POST		2 100 mm	114 mm	38 mm	
D – STRUT		1 850 mm	114 mm	38 mm	
E – QUEEN POST		1 550 mm	114 mm	38 mm	
TOTAL LENGTH REQUIRED FOR TEN TRUSSES					

(12)

4.1.2   If the timber is only available in 6 metre lengths, calculate the number of lengths that must be purchased.

(3)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 5.1

ANSWER SHEET 5.1

5.1.1　Vector diagram

a

5.1.2　Space diagram

20 N

C

E

B

D

60°　　　　60°

A

50 N

(1)
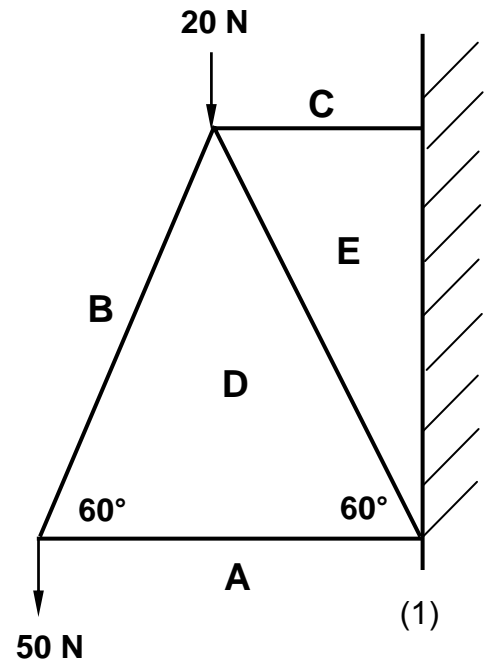
(4)

5.1.3

MEMBER	MAGNITUDE	NATURE
BD		
DA		
CE		
ED		

(8)

CENTRE NUMBER:

EXAMINATION NUMBER:

QUESTION 6.1

ANSWER SHEET 6.1

No.	QUESTIONS	ANSWERS	MARKS
1	What is the scale of the drawing?		1
2	What is the site number on the western side of the proposed building?		1
3	Identify number 1.		1
4	Identify number 2.		1
5	What is the street name on the south side of the site?		1
6	What is the number of the site on which the proposed building is to be erected?		1
7	What colour is used to indicate new buildings on a site plan?		1
8	What is the length of the boundary line on the eastern side of the site?		1
9	Calculate the total perimeter of the house.		2
10	Calculate the total area of the site.		2
11	Calculate the total area of the proposed house.		2
12	Calculate the percentage area that the proposed house will occupy on the site.		1

(15)

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CENTRE NUMBER: | | | | | | | | |

EXAMINATION NUMBER: | | | | | | | | | | | | | |

QUESTION 6.2

ANSWER SHEET 6.2

(25)

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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	Pi = $\frac{22}{7}$ = 3,142	Ø	Diameter	V	Volume

FORMULAE

AREA OF	FORMULA (in words)	FORMULA (in symbols)	FORMULA FOR THE POSITION OF CENTROID	
			X-axis	**Y-axis**
Square	Side x Side	s x s	$\frac{s}{2}$	$\frac{s}{2}$
Rectangle	Length x Breadth	l x b	$\frac{l}{2}$	$\frac{b}{2}$
Right-angled triangle	½ x base x height	½b x h	$\frac{b}{3}$	$\frac{h}{3}$
Equilateral triangle/ Pyramid	½ x base x height	½b x h	$\frac{b}{2}$	$\frac{h}{3}$
Circle	π x radius x radius	πr²	Centroid is in the centre	
Circle	π x diameter x diameter divided by 4	$\frac{πd^2}{4}$		
Semicircle	π x radius x radius divided by 2	$\frac{πr^2}{2}$	Centroid is 0,424r on the centre line	

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

OR

$$X = \frac{\sum Ay}{\sum A}$$

$$\text{Deformation (strain)} = \frac{\text{Change in length (mm)}}{\text{Original length (mm)}}$$