higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

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APRIL EXAMINATION

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

1 April 2014 (Y-Paper)
13:00–16:00

Calculators may be used.

This question paper consists of 5 pages, 2 diagram sheets and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING SCIENCE N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write down the formula BEFORE you start your calculations.
5. ALL sketches and/or diagrams must be done in pencil.
6. The sketches and/or diagrams must be reasonably large and fully labelled.
7. Assume that 1 kg of mass exerts a force of 10 N.
8. Write neatly and legibly.

QUESTION 1

Define the following terms as found in building science:

1.1. Relative density of a material (specific gravity) (3)

1.2 Capillary action (2)

1.3 Thermal capacity of a material (3)

1.4 Torque (2)
[10]

QUESTION 2

2.1 Describe the working principles of a hydrometer. (3)

2.2 Study the statement below and answer the questions.

If we place a brick in a container full of water, hundreds of tiny bubbles come to the surface. We say that the brick is porous.

2.2.1 What causes the air bubbles to appear? (2)

2.2.2 Describe how the manufacturing process of bricks makes them porous. (2)

2.2.3 Describe how timber (wood) becomes porous. (2)

2.3 The bulk volume of a material is 5,46 cm^3 and its solid volume is 4,02 cm^3. The material absorbed 1.30 cm^3 of water.

Calculate the saturation coefficient of the material. (6)
[15]

QUESTION 3

3.1 Describe TWO precautions that one would take to avoid frost damage to exposed building components. (2)

3.2 Explain the working of a domestic hot-water heating cylinder. (4)

3.3 Calculate the mass of water required if 700 kJ of heat is given out when the temperature of the water drops from 90 °C to 60 °C. The specific heat capacity of water is 4,2 kJ/kg°C. (4)
[10]

QUESTION 4

4.1 Explain what is meant by the term *permeability* with reference to roofing materials. (1)

4.2 Will corrugated iron sheeting be a suitable roof cover for coastal areas? Motivate your answer. (3)

4.3 Copy the following table in your ANSWER BOOK and complete it by writing YES, NO or FAIR in the spaces provided.

ROOF COVERING	DURABLE	HAIL RESISTANT	HEAVY
Clay tiles			
Glass fibre sheets			
Slate tiles			
Thatch			

(12 x ½) (6)
[10]

QUESTION 5

Figure 1 (DIAGRAM SHEET 1) shows a beam X-Z which is 13 meters long and simply supported at L and R. The beam is loaded as indicated in the sketch and has a weight of 8 kN.

5.1 Calculate the reactions at L and R by taking moments about any suitable point. Control/Test your answer. (10)

5.2 Calculate the reactions at L and R if the point loads on this beam are replaced by an evenly distributed load of 10 kN per metre length over the whole length of the beam. Control/Test your answer. (8)
[18]

QUESTION 6

Figure 2 (DIAGRAM SHEET 1) shows the dimensions of a thin metal plate of uniform thickness.

Determine the position of the centroid from side AB by calculation only.
NB: NO MARKS will be allocated for a graphical solution. **[12]**

QUESTION 7

7.1 Figure 3 (DIAGRAM SHEET 1) shows a pin-jointed frame in equilibrium.

Use a suitable scale and draw the force diagram and determine the magnitude of the forces in the members. (15)

7.2 Neatly tabulate your answers from QUESTION 7.1 in the ANSWER BOOK according to the following TABLE.

MEMBER	MAGNITUDE (KN)	NATURE	
		TIE	STRUT
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

(10)
[25]

TOTAL: 100

DIAGRAM SHEET 1

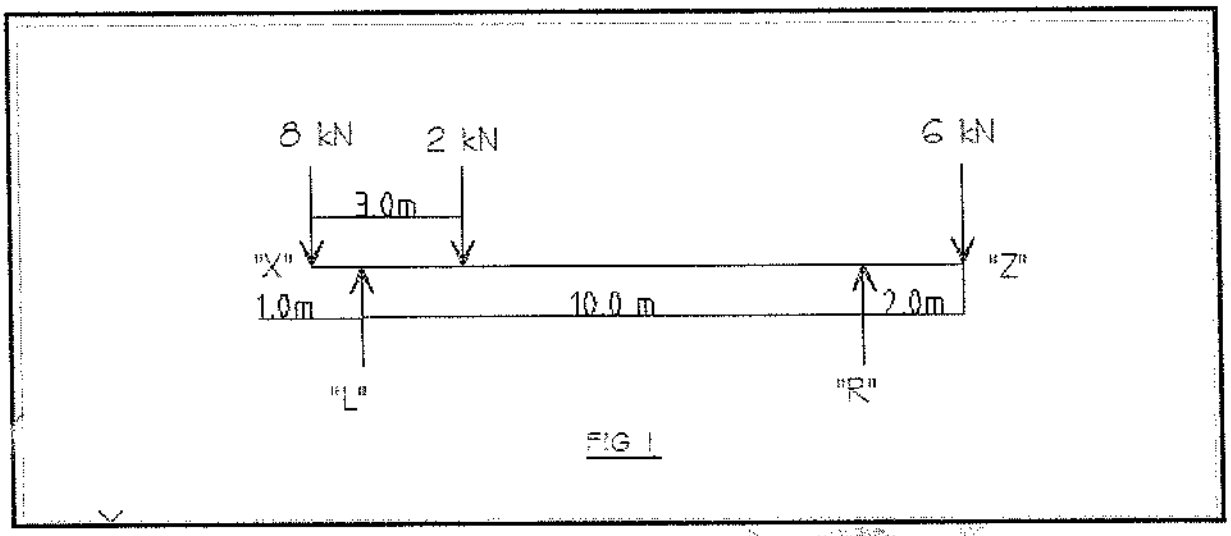

FIG 1

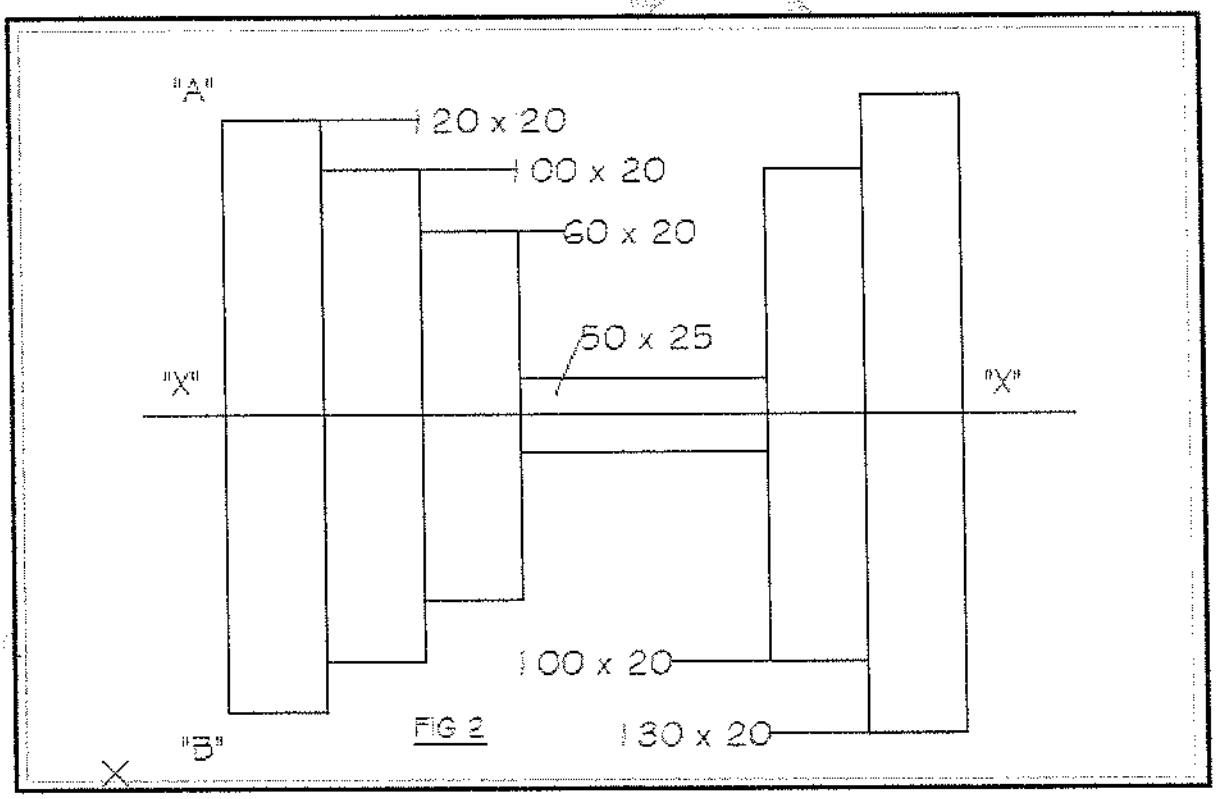

FIG 2

NB: FIGURE 1 should be showing 8 kN at the centre of the beam (per statement given)

DIAGRAM SHEET 2

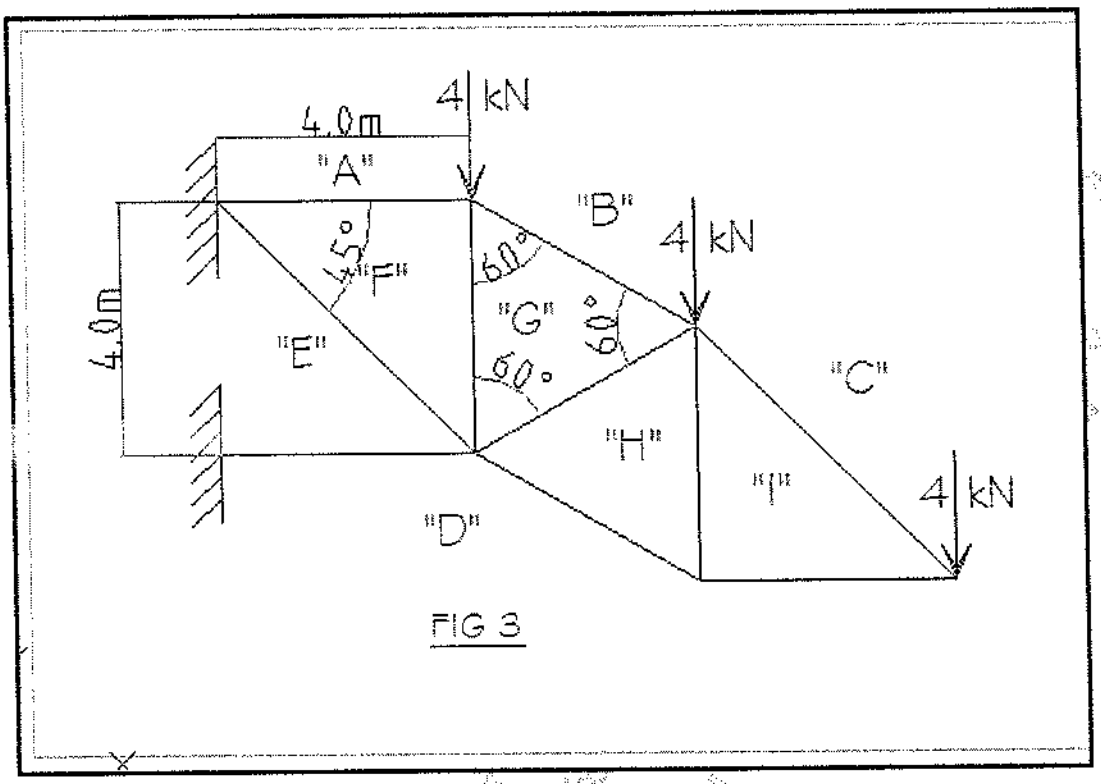

FIG 3

FORMULA SHEET

Any applicable formula may be used.

1. F =m x g
2. Sinø = O/H Sinø = T/S
3. Cosø = A/H Cosø = A/S
4. Tanø = O/A Tanø = T/A
5. $A = \pi \frac{D^2}{4} = \pi r^2$
6. A = ½(B x H) A = ½(L x B)
7. $V = \pi \frac{D^2}{4} x H$
8. ∑ CM = ∑ ACM
9. ∑ ↑F = ∑ ↓F
10. V = L x B x H
11. M = F x s
12. K = C + 273
13. Moment of area = area x distance from axis
14. VC = W. Sinø VK = W. Sinø
15. HC = W. Cosø HK = W. Cosø
16. $y = \frac{\sum My}{\sum A}$
17. $D = \frac{M}{V}$
18. $RD = \frac{DxS}{DxW} = RD = \frac{MxS}{MxW}$
19. $\Delta L = Lo\ x\ \Delta T\ x\ \alpha$
20. Heat required = $m\ x\ \Delta t\ x\ SHC$
21. $\%\ porosity = \frac{Bulk\ volume - Solid\ volume}{Bulk\ volume} x\ 100\%$
22. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$