higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

29 July 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 4 pages, 2 diagram sheets and 1 formula sheet.

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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. All sketches and diagrams must be done in pencil.
5. Assume that 1 kg of mass exerts a force 10 N.
6. Round off to THREE decimal places.
7. Write down the formula before you start your calculations.
8. Write neatly and legibly.

QUESTION 1

1.1 What is the main purpose of roof covering? (3)

1.2 Roof covering is one important component of a house.

Name FIVE factors to be considered when deciding on roof covering. (5)

1.3 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.3.1–1.3.2) in the ANSWER BOOK. Correct the statement if it is FALSE.

1.3.1 Thatch roof is durable, heavy and it is economical.

1.3.2 A disadvantage of Malthoid is that it is expensive.

(4)
[12]

QUESTION 2

The beam shown in FIGURE 1, DIAGRAM SHEET 1 (attached), is held at equilibrium by the reactions R_L and R_R.

2.1 Calculate the magnitude of support R_L by taking moments about R_R. (5)

2.2 Calculate the magnitude of support R_R by taking moments about R_L. (5)

2.3 Test your answer by considering the sum of the upward forces and sum of the downward forces. (3)
[13]

QUESTION 3

3.1 Define the following terms:

3.1.1 Conduction

3.1.2 Convection

3.1.3 Radiation

(3 × 3) (9)

3.2 Convert the following:

3.2.1 75 °C to Kelvin (K) (3)

3.2.2 330 K to °C (3)

3.3 If you mix 5 ℓ of water with a temperature of 35 °C and 7 ℓ of water with a temperature of 90 °C. Calculate the final temperature if the s.h.c of water is 4 200 J/kg°C. (5)
[20]

QUESTION 4

4.1 A piece of metal plate of even thickness is shown in FIGURE 3, DIAGRAM SHEET 2 (attached). The compound section is symmetrical about the A–A. All measurements are in millimetres.

4.1.1 Calculate the total area of the compound section. (5)

4.1.2 Determine the distance of the centroid of each section from 'X–X'. (4)

4.1.3 Calculate the sum of the moments of the section about 'X–X'. (6)

4.1.4 Calculate the position of the centroid of the compound section from 'X–X'. (4)

4.2 Redraw the metal plate from FIGURE 3, DIAGRAM SHEET 2 (attached). and show the position of the centroid, using any suitable scale. (4)

[23]

QUESTION 5

5.1 Name TWO types of forces that a frame is subjected to. (2)

5.2 FIGURE 2, DIAGRAM SHEET 1 (attached) shows a simple supported roof truss with two supports R_L and R_R. Use the following scale:

Linear scale 1 m = 10 mm and a Force scale of 1 mm = 1 kN.

5.2.1 Redraw the space diagram. (4)

5.2.2 Calculate the reactions at the support and complete the vector diagram required to analyse the forces in the members. (7)

5.2.3 Determine the magnitude and nature of the forces in each member of the frame and neatly tabulate the findings. (5)

[18]

QUESTION 6

6.1 The system of coplanar, concurrent forces shown in FIGURE 4, DIAGRAM SHEET 2 (attached) is held in equilibrium by Force 'Q'.

Use the following scale: Linear scale 1 m = 10 mm and a Force scale of 1 mm = 1 kN.

6.1.1 Redraw the space diagram and complete a Bow's Notation. (3)

6.1.2 Determine by graphical means the magnitude and direction of force 'Q'.

NOTE: (No marks will be given for any calculations) (8)

6.2 Define the term *triangle of forces*. (3)

[14]

TOTAL: 100

DIAGRAM SHEET 1

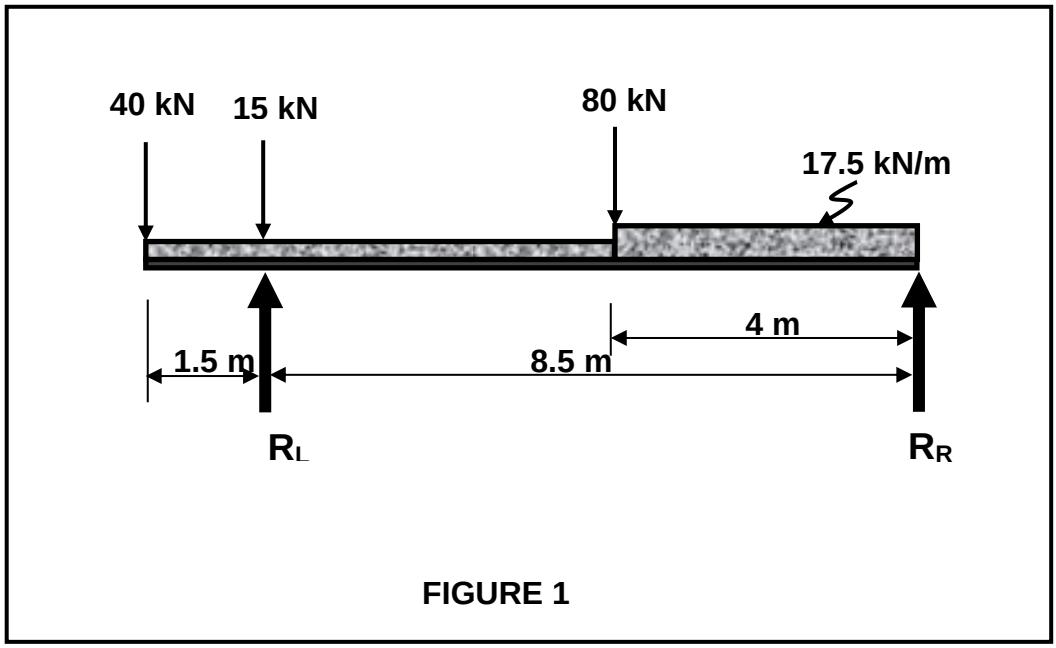

FIGURE 1

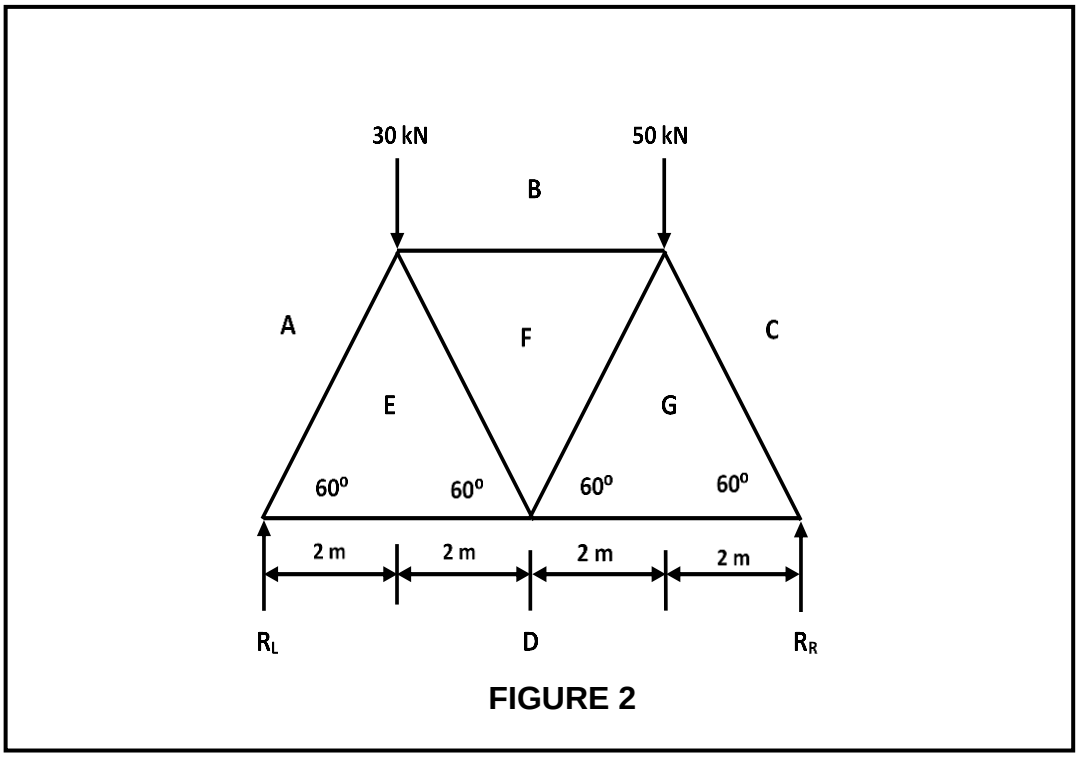

FIGURE 2

DIAGRAM SHEET 2

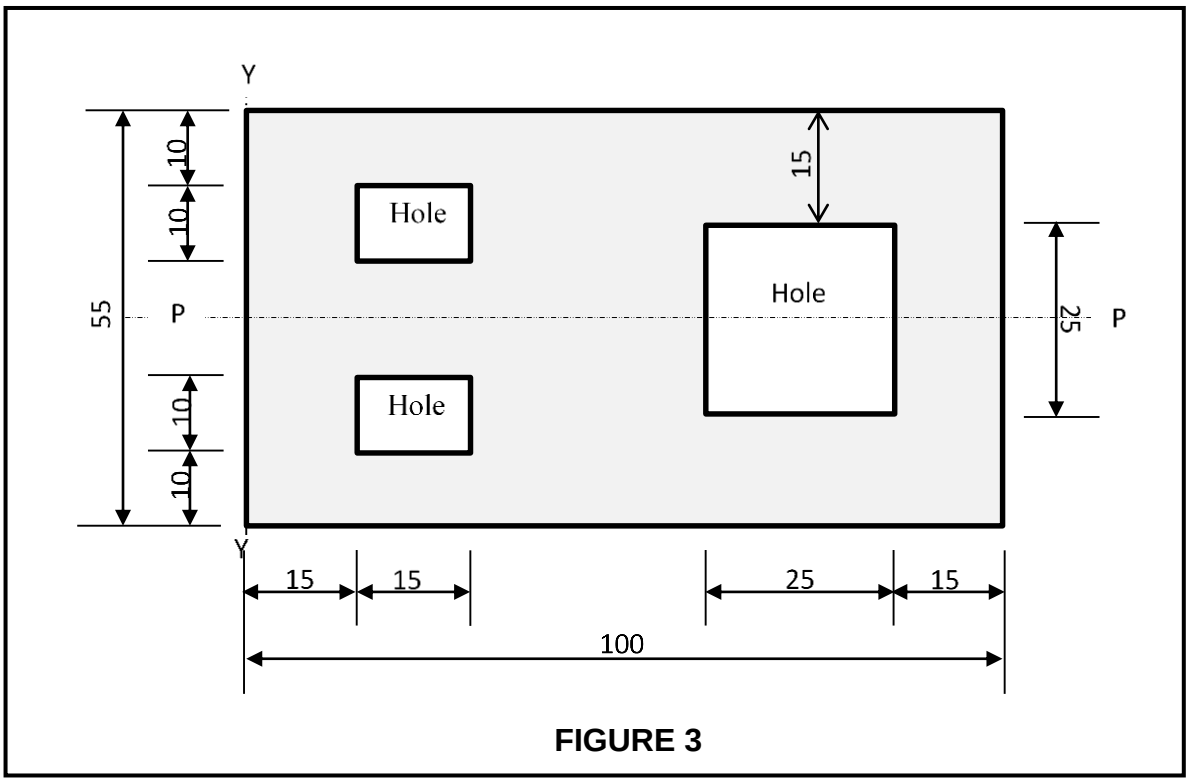

FIGURE 3

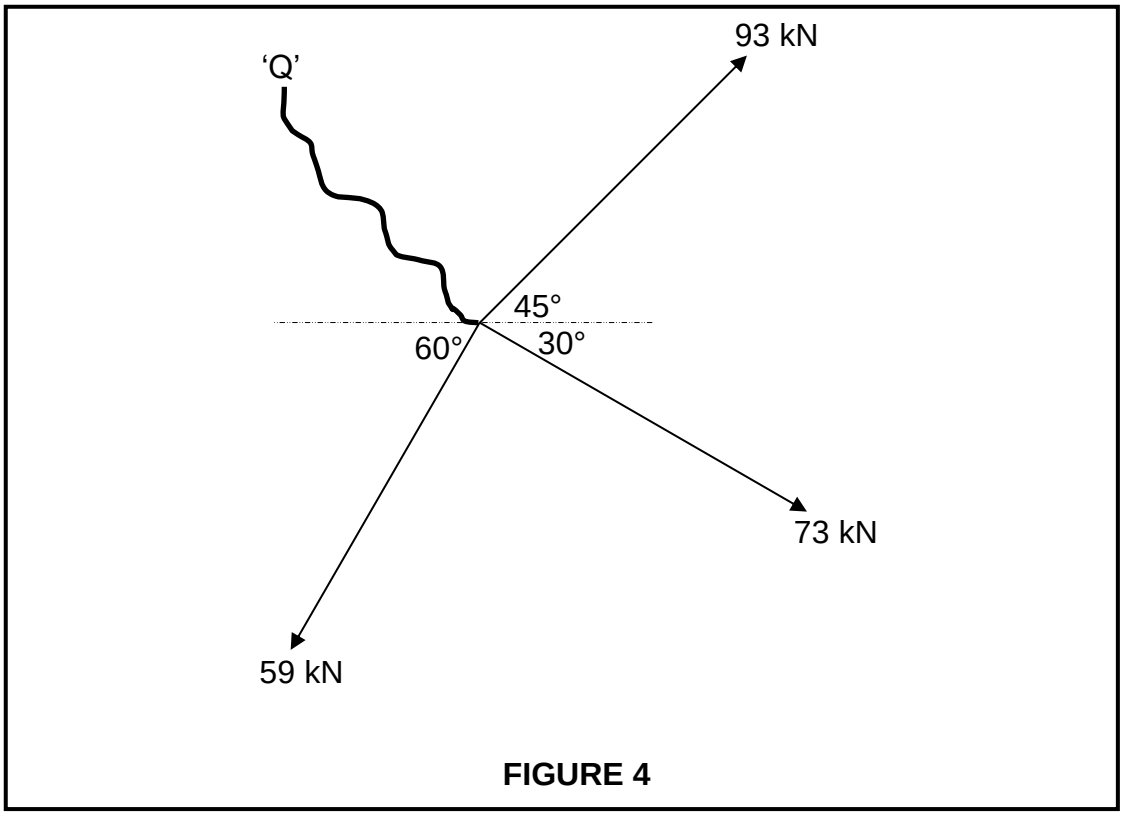

FIGURE 4

BUILDING SCIENCE N2

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. $A = \pi\frac{D^2}{4}$ = π r²
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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$