higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T240**(E)**(J31)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(15070012)

31 July 2019 (X-Paper)
09:00–12:00

Drawing instruments and calculators may be used.

This question paper consists of 6 pages 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. Sketches must be large, neat and fully labelled.
5. ALL drawings must be done in pencil to the required scale.
6. Write neatly and legibly.

QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'True' or 'False' next to the question number (1.1.1–1.1.3) in the ANSWER BOOK. Correct the statement if it is FALSE.

1.1.1 An absorptive solid is the quantity of water which is retained by a material.

1.1.2 Absorption and permeability can both be described as a quantity of water which passes through the material.

1.1.3 A porous material is able to absorb water. The water in which it is immersed pushes the air out of the material.

(7)

1.2 Explain *capillarity* with reference to voids in a burnt clay brick. (3)

1.3 Explain *porosity* with reference to burnt clay bricks. (3)

1.4 A brick has a volume of 6,4 cm^3 and after having been crushed the absolute volume of the powder is 4,5 cm^3.

Calculate the porosity percentage of the brick. (4)

[17]

QUESTION 2

The beam shown in FIGURE 1 is held in equilibrium by the reactions R_L and R_R.

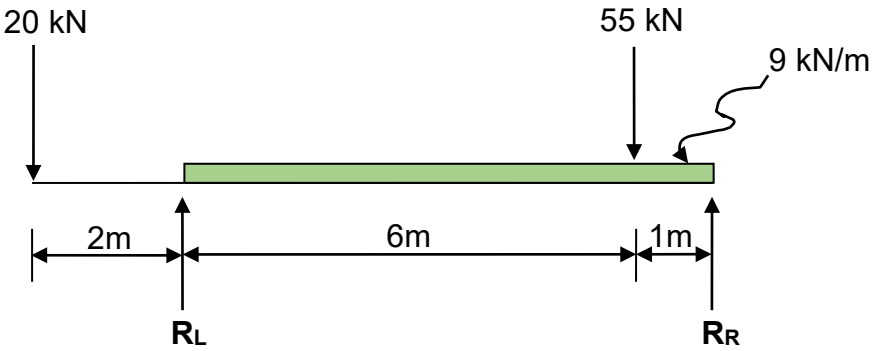

FIGURE 1

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 the answers by taking into account the sum of the upward forces and the sum of the downward forces. (3)

[13]

QUESTION 3

3.1 Explain the difference between *tensile forces* and *compressive forces*. (4)

3.2 FIGURE 2 shows a simple supported roof truss with two supports R_L and R_R, which is 12 m apart. Use the linear scale 1 m = 10 mm and the force scale 1 mm = 1 kN.

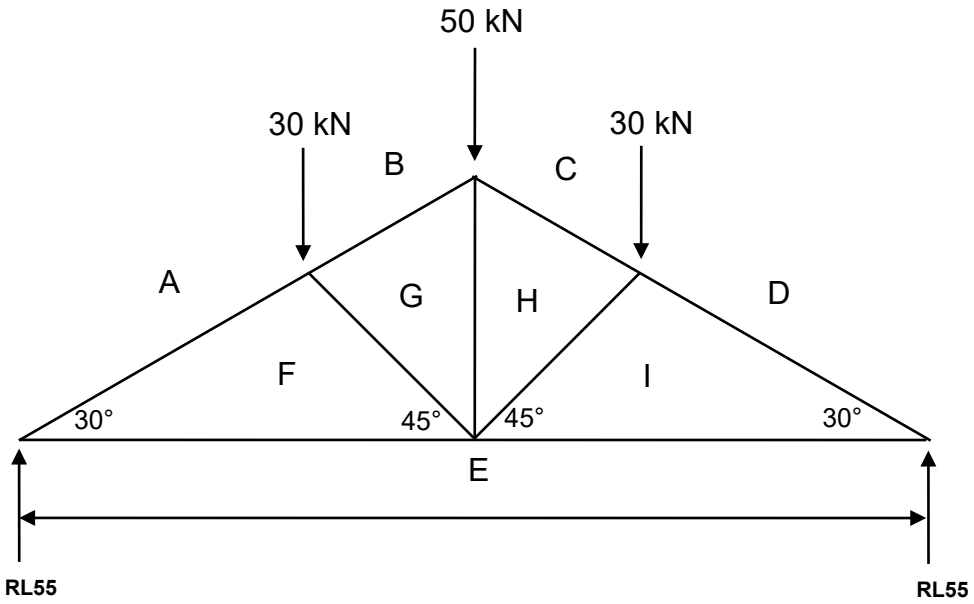

FIGURE 2

3.2.1 Redraw the space diagram in your ANSWER BOOK and indicate the struts and ties. (2)

3.2.2 Complete the vector diagram required to analyse the forces in the members. (6)

3.2.3 Determine the magnitude and nature of the forces in each member of the frame and neatly tabulate the findings. (9)

[21]

QUESTION 4

FIGURE 3 shows a metal plate of even thickness with a circular hole. The compound section is symmetrical about the X-X axis. All measurements are in millimetres.

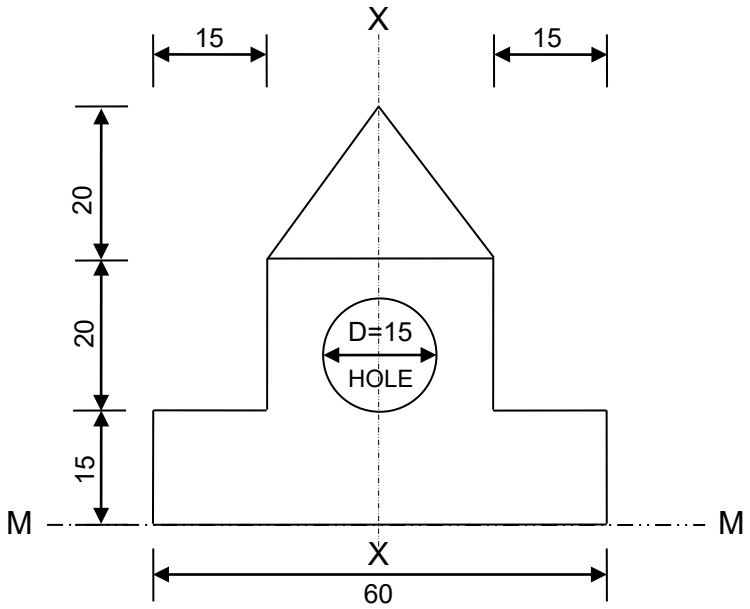

FIGURE 3

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

4.2 Determine the distance of the centroid of each section from M-M. (4)

4.3 Calculate the sum of the moments of the section about M-M. (6)

4.4 Calculate the position of the centroid of the compound section from M-M. (3)

[18]

QUESTION 5

5.1 The system of coplanar concurrent forces shown in FIGURE 4 is held in equilibrium by the force R.

Calculate the magnitude and direction of R by adding the components of the given forces. (12)

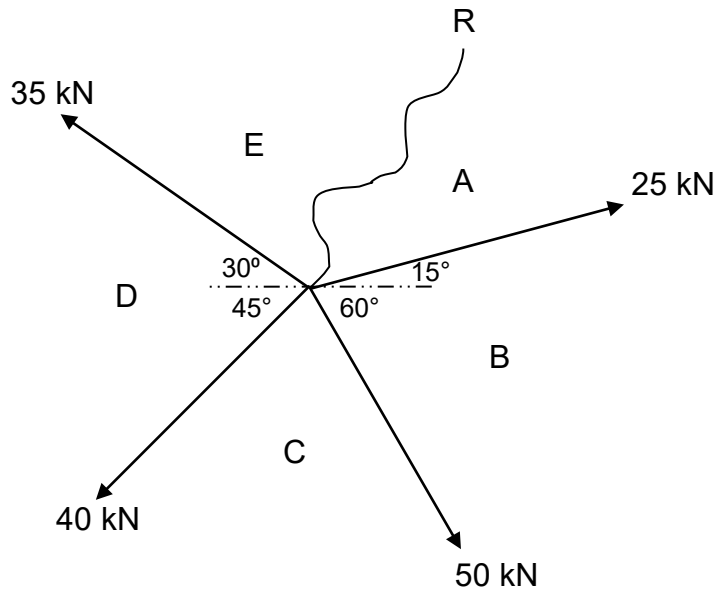

FIGURE 4

5.2 Explain the difference between *coplanar* and *concurrent.* (4)
[16]

QUESTION 6

6.1 Write down the words of the abbreviation 'shc' in full. (1)

6.2 Define the term *coefficient of linear expansion*. (3)

6.3 Name THREE changes that happen when a material is heated. (3)

6.4 Make a neat sketch to show a method of preventing damage to a long brick wall due to expansion. (4)

6.5 Calculate the coefficient of linear expansion of a steel rod if the length of the steel rod increases from 6 m to 6,004 m as a result of a temperature change from 30 °C to 55 °C. (4)
[15]

TOTAL: 100

(15070012)

BUILDING SCIENCE N2

FORMULA SHEET

Any other applicable formula may also 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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$