higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T200**(E)**(A1)T
APRIL EXAMINATION

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

(8090012)

1 April 2016 (X-Paper)
9:00–12:00

Drawing instruments and 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. ALL the drawings must be drawn to the required scale.
5. ALL drawings, including candidate's information, must be done in pencil.
6. Ink pens are NOT allowed.
7. ALL drawing work must comply with the relevant SANS (SABS) recommended codes.
8. Use your own discretion where dimensions are not given.
9. ALL the abbreviations and symbols must comply with the latest National Building Regulations and all relevant SANS (SABS) codes.
10. The sketches and/or diagrams must be neat, reasonably large, in proportion and fully labeled.
11. ALL labeling must be written in capital letters.
12. Write neatly and legibly.

QUESTION 1

A metal plate of even thickness is shown in FIGURE 1, DIAGRAM SHEET 1. The metal has 1 rectangular hole and the compound section is symmetrical about the X–X axis.

1.1 Redraw the figure to scale 1 : 10 in the ANSWER BOOK. (2)

1.2 Calculate the total net area of the compound section. (2)

1.3 Determine the distance of the centroid of each section from X–X. (3)

1.4 Calculate the sum of the moments of the sections about X–X. (4)

1.5 Calculate the position of the centroid of the compound section from X–X. (3)
[14]

QUESTION 2

FIGURE 2, DIAGRAM SHEET 1 shows a pin-jointed frame that is in equilibrium. ALL angles are 60°.

2.1 Calculate the reactions RL and RR. (4)

2.2 Redraw the space diagram to scale 1 : 10. (2)

2.3 Complete the vector diagram to scale 1 kN = 5 mm. (7)

2.4 Calculate the nature and magnitude of each member from the vector diagram and tabulate your answers. (11)
[24]

QUESTION 3

The lever arm in FIGURE 3, DIAGRAM SHEET 1 is in equilibrium with a turning point at the pivot, the lever arm is under the influence of applied force F and forces of 70 kN and 50 kN.

3.1 Redraw the space diagram to scale 1 : 10. (2)

3.2 Calculate the magnitude of force F. (5)

3.3 Draw the vector diagram to scale 2 kN = 1 mm. (4)
[11]

QUESTION 4

4.1 Determine graphically the magnitude and direction of the unknown forces N and M shown in FIGURE 4, DIAGRAM SHEET 2, by reproducing the given space diagram and completing the required vector diagram (force diagram) to scale 1 mm : 1 kN. (9)

4.2 Calculate the direction and magnitude of the three known forces (120 kN, 78 kN and 70 kN). Tabulate your answers neatly in your ANSWER BOOK. (8)

4.3 Calculate the magnitude and direction of the resultant force. (4)
[21]

QUESTION 5

The beam shown in FIGURE 5, DIAGRAM SHEET 2 is held in equilibrium by the reactions RL and RR.

5.1 Take moments about RL to calculate the magnitude of RR. (3)

5.2 Take moments about RR to calculate the magnitude of RL. (3)

5.3 Test your answers to prove equilibrium. (2)
[8]

QUESTION 6

6.1 The mass of an object weighed in water is 13 kg. The mass of the same object weighed in the air is 19 g.

Determine the specific gravity of the object. (3)

6.2 A load of 150 metric tons is placed in the middle of a raft. The raft measuring 16 m × 6 m is floating on the water.

By how much will the raft sink deeper into the water after the load has been applied onto the raft? (9)
[12]

QUESTION 7

7.1 Heat can be transferred in three ways: through conduction, convection and radiation.

Explain what you understand under these terms. (6)

7.2 An overhead telephone wire must be connected over a distance of 2 km. The temperature in the area varies between 7 °C on the coldest day and 46 °C during a hot summer's day.

What allowance must be made for the wire to contract if the wire is connected on the hottest summer's day? The coefficient of linear expansion of the wire is 25×10^{-6}/°C. (4)

[10]

TOTAL: 100

DIAGRAM SHEET 1

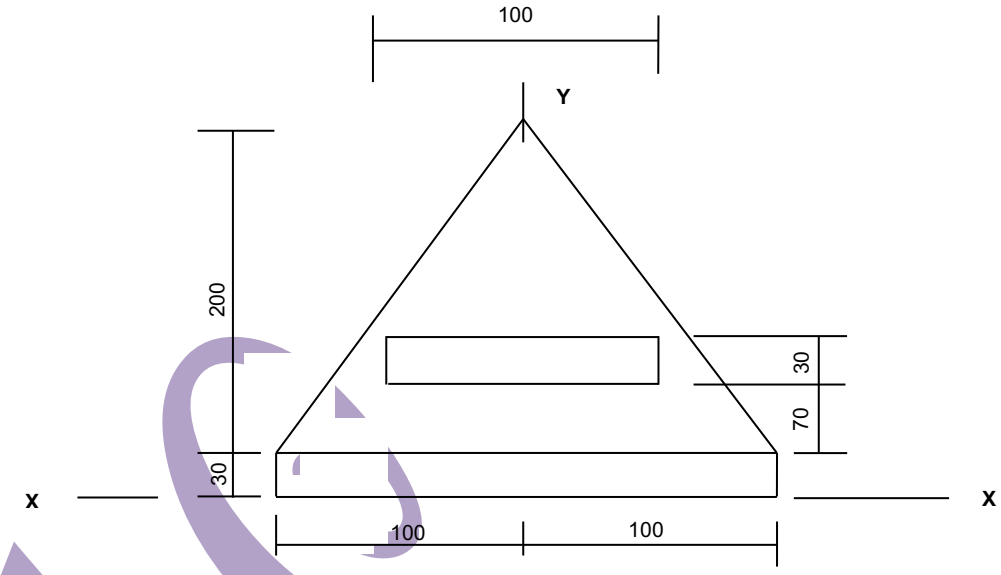

FIGURE 1

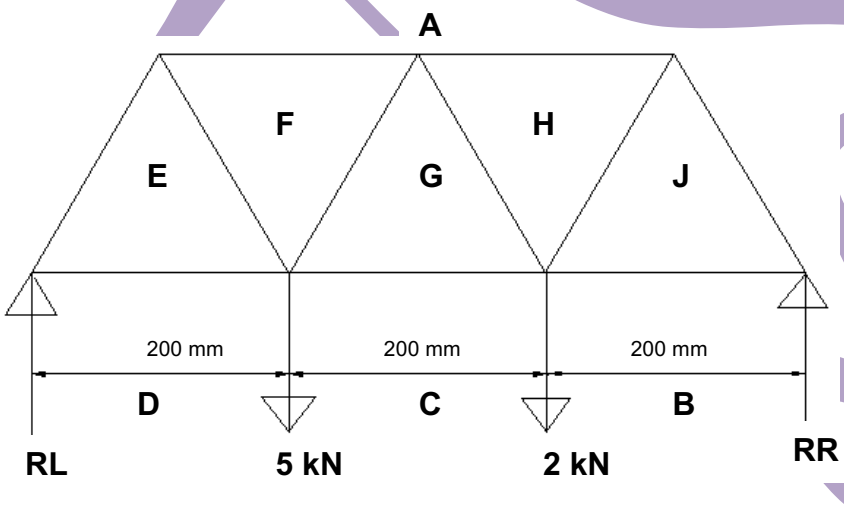

FIGURE 2

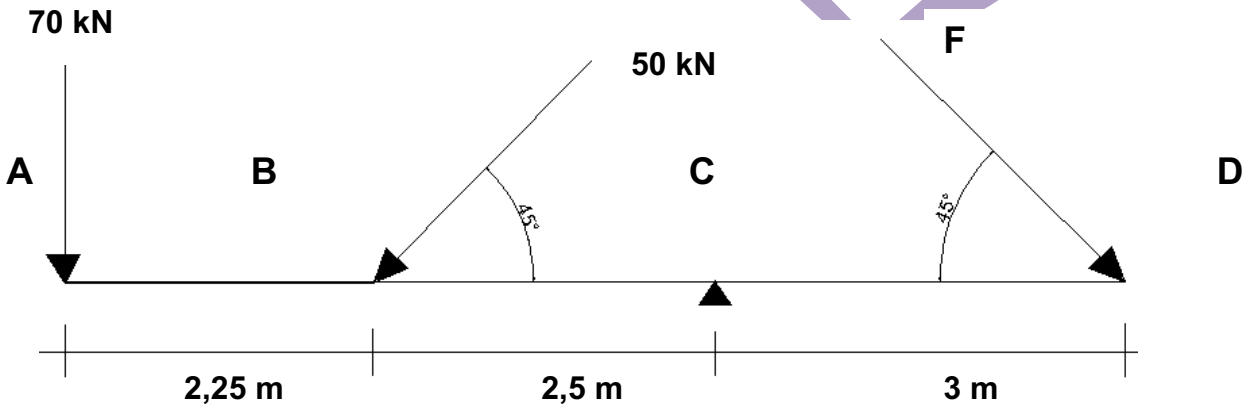

FIGURE 3

DIAGRAM SHEET 2

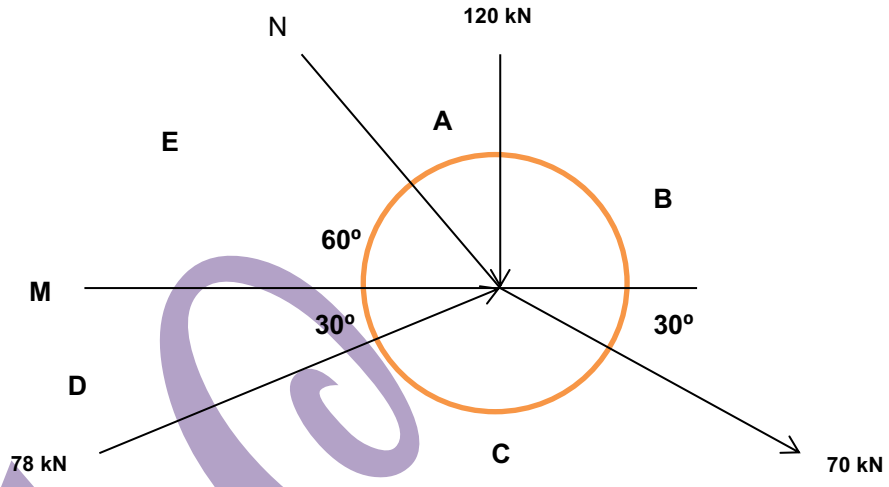

FIGURE 4

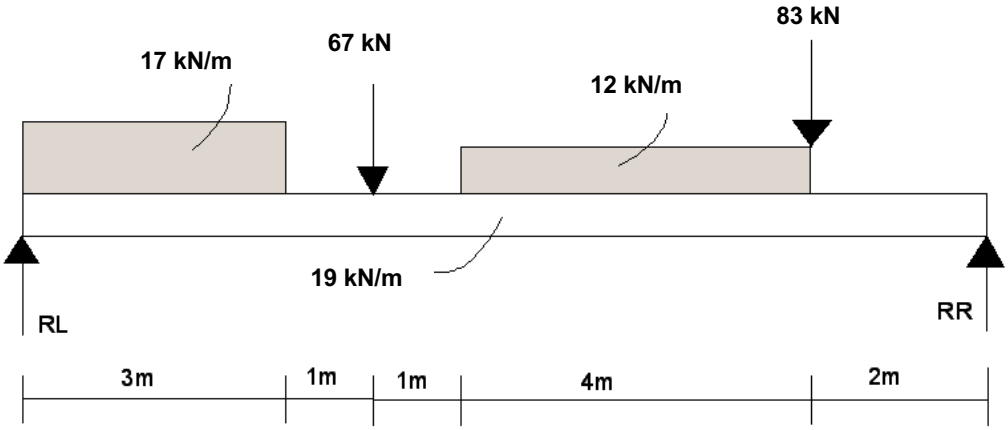

FIGURE 5

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. $saturation\ coefficiant = \frac{volume\ of\ water\ absorbed}{bulk\ volume - solid\ volume}$