higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

17 November 2022 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 7 pages and a formula sheet.

064Q1E2217

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING SCIENCE N3
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. Intermediate and final calculations must be rounded off to 2 decimal places.
5. Start each section on a new page.
6. Assume that acceleration due to gravity, g, is 9,81m/s^2.
7. Use only a black or a blue pen.
8. Write neatly and legibly.

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QUESTION 1

There are different types of paint failures. Explain the causes of each of the following:

1.1 Blistering

1.2 Bleeding

1.3 Peeling

1.4 Wrinkling

1.5 Chalking

(5 × 2) **[10]**

QUESTION 2

2.1 Analytically determine the magnitude of reactions R_A and R_F on the beam shown in FIGURE1 below.

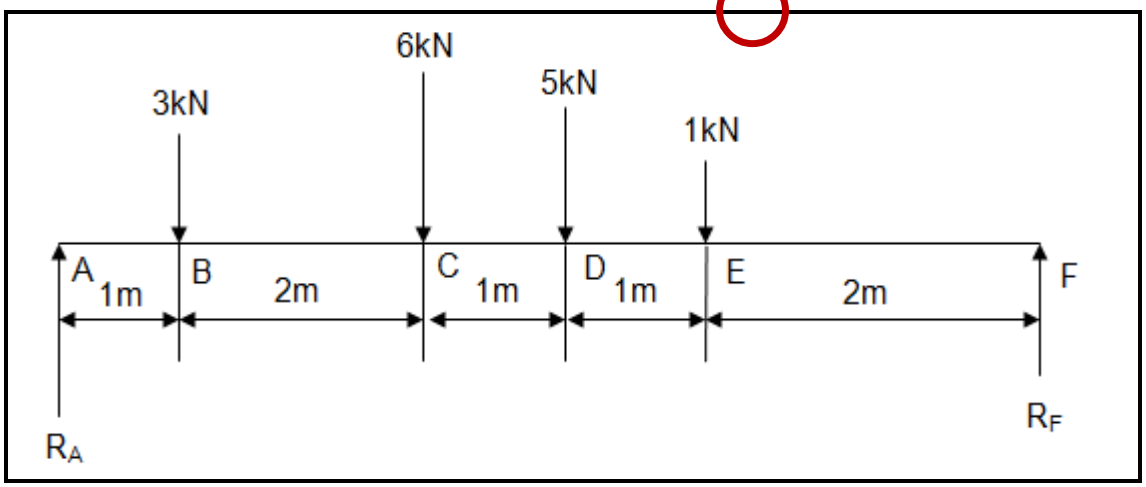

FIGURE 1

(1,5 × 2) (3)

2.2 Draw a neat and fully labelled shear force diagram to a linear scale of 1 cm:0,5 m and a force scale of 1 cm:2 kNm. (6)

2.3 Draw a fully labelled bending moment diagram to a linear scale of 1 cm:0,5 m and a force scale of 1 cm:2 kNm. (6)

[15]

QUESTION 3

A block with a mass of 30 kg rests on an inclined plane of 28° to the horizontal. The coefficient of friction between the surfaces is given as 0,7.

Calculate the following:

3.1 The components of weight of the block perpendicular to the plane.

3.2 The components of weight of the block parallel to the plane.

3.3 The frictional force.

3.4 The smallest parallel force to the plane required to move the block up the plane.

3.5 The smallest parallel force to the plane required to move the body down the plane.

(5 × 3) **[15]**

QUESTION 4

Refer to FIGURE 2 below:

4.1 Use a scale 1 cm:0,5 m to redraw the space diagram to determine the distance accurately. (2)

4.2 Calculate the following:

4.2.1 The magnitude of the reaction RR

4.3.2 The magnitude of the reaction RL

(2 × 2) (4)

4.3 Use a scale 1 cm:1 kN to draw a vector diagram to determine the magnitude and nature of forces acting on the frame shown in FIGURE 2 below. Reproduce TABLE 1 in your ANSWER BOOK and tabulate your solutions in the applicable spaces.

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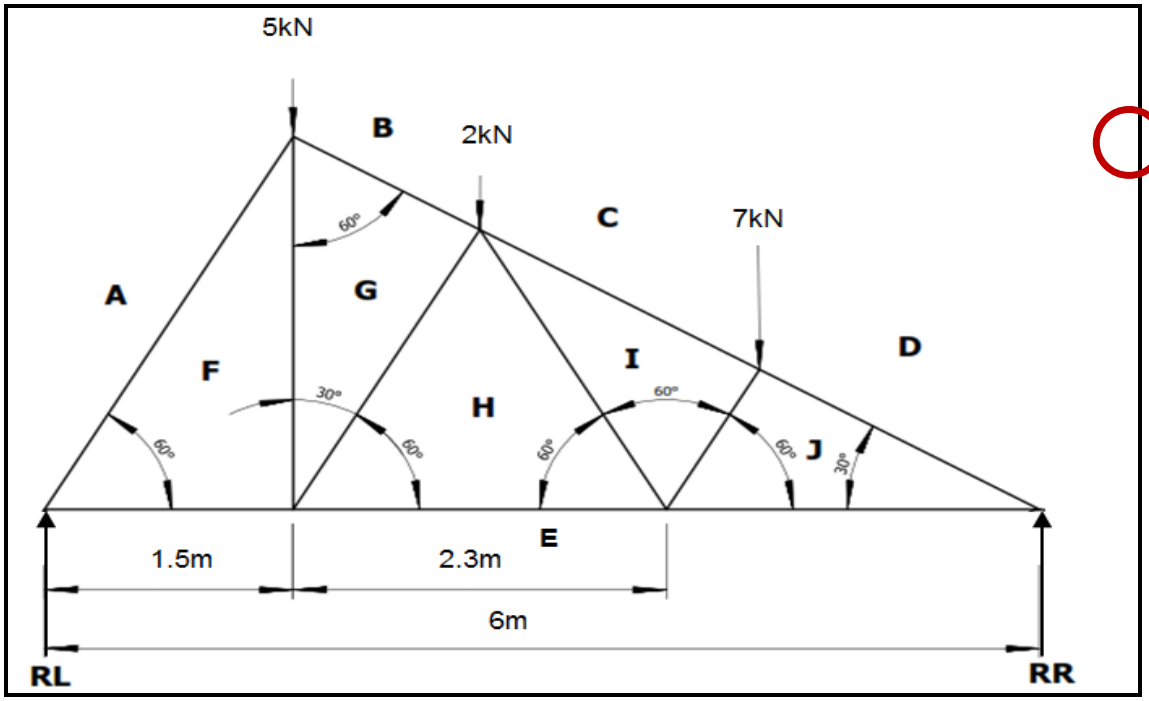

FIGURE 2

MEMBER	MAGNITUDE (kN)	NATURE
AF		
FG		
BG		
GH		
EF		
CI		
HI		
EH		
IJ		
DJ		
EJ		

TABLE 1

(16)
[20]

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QUESTION 5

FIGURE 3 below shows a plane laminar.

Calculate the centroid of the laminar with reference to OA and OB respectively measured in mm. Copy TABLE 2 in the ANSWER BOOK and use it for your calculations.

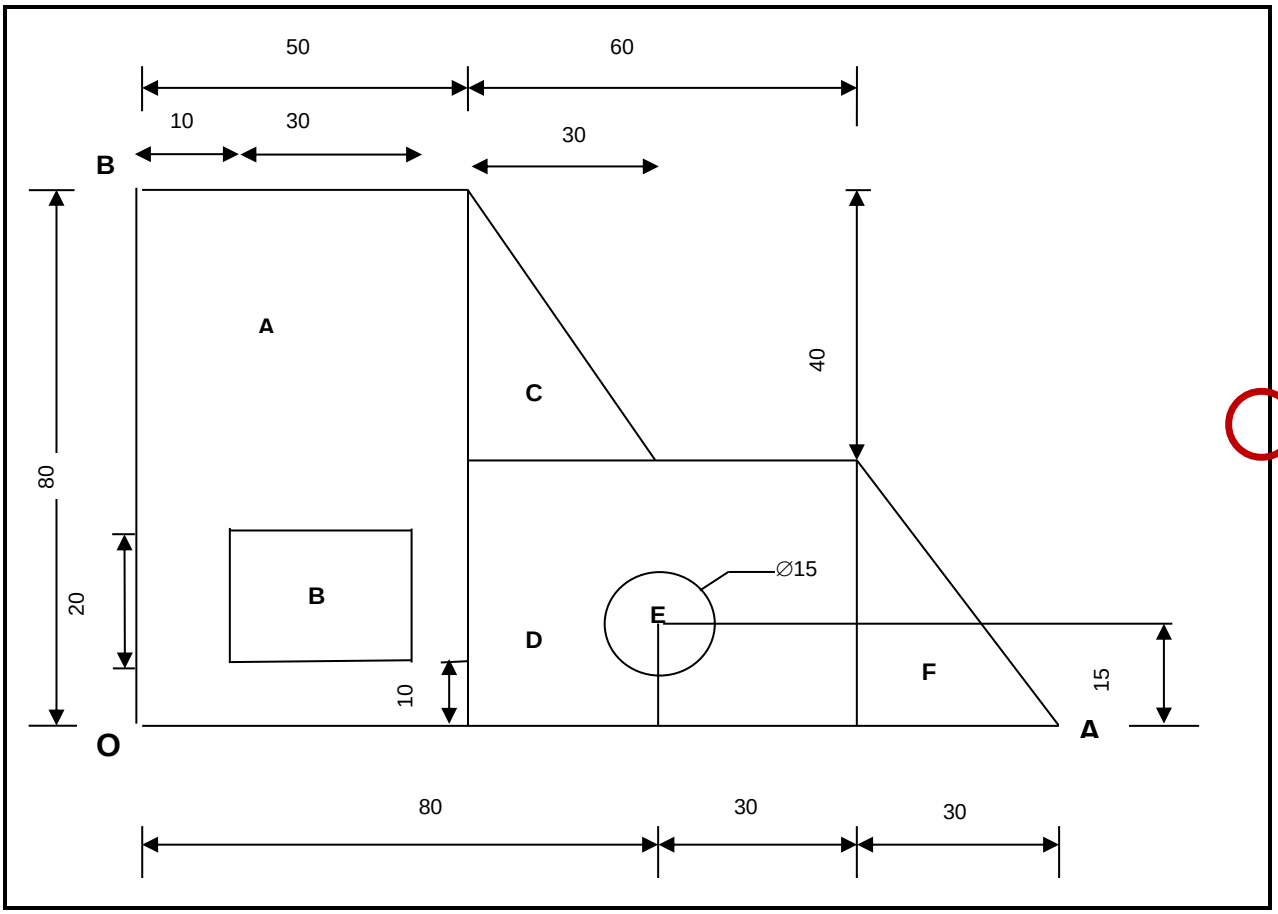

FIGURE 3

Shape	Area [mm^2]	X [mm]	Y [mm]	Moments Ax [mm^3]	Moments Ay [mm^3]
A					
B					
C					
D					
E					
F					
TOTALS					

TABLE 2

[20]

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QUESTION 6

A pair of shear legs is 4 m in length and with a load of 20 kN suspended from the apex overhang being 2 m. The backstay is 5 m long and the two shear legs are 4 m apart at the base.

Graphically determine the magnitude of force in each leg. **[10]**

QUESTION 7

7.1 Define *Ohm's law*. (2)

7.2 The numbers 160 V and 40 W are written on an electric lamp.

Calculate the following:

7.2.1 The current flowing through the lamp. (2)

7.2.2 The resistance of the lamp. (2)

7.2.3 The cost to operate the lamp for 6 hours at R1,10 per unit. (4)

[10]

TOTAL: 100

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FORMULA SHEET

Any other applicable formula may also be used.

1. $F = m \times g$
2. $A = \frac{\pi D^2}{4}$
3. $F\mu = \mu \times W$
4. $\mu = \tan \phi$
5. Comp. $* = W \sin \phi$
   Komp. $* = W \sin \phi$
6. Comp. $\zeta = W \cos \phi$
   Komp. $\zeta = W \cos \phi$
7. $F1 = \mu W \cos \phi + W \sin \phi$
8. $F\mu = \mu W \cos \phi$
9. $F2 = \mu W \cos \phi - W \sin \phi$
10. $s = ut + \frac{1}{2}at^2$
11. $v = u \pm 2as$
12. $v = u^2 \pm at$
13. $M = m_ \times v$
14. $m \times u = m \times v$
15. $VR = \frac{Effort\ distance}{Load\ distance}$
    $SV = \frac{Magafstand}{Lasafstand}$
16. $MA = \frac{Load}{Effort}$
    $HV = \frac{Las}{Mag}$
17. $n = \frac{HV}{SV} \times 100$
18. $V = I \times R$
19. $R_T = R_1 + R_2 + R_3$
20. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$
21. $P = V \times I$
22. $W = P \times t$
23. $AV = F \times S$
    $WD = F \times S$
24. $MOM = F \times \zeta S$
25. $A = L \times B$
26. $A = \pi r^2$
27. $A = \frac{1}{2}\ bh\ /\ \frac{1}{2}ab\sin C$
28. $A = 4\pi r^2$
29. $\bar{x} = \frac{4r}{3\pi}$
30. $\bar{x} = \frac{1}{3}h$
31. $R = \sqrt{HK^2 + VK^2}$
    $R = \sqrt{HC^2 + VC^2}$
32. $\text{TAN}\phi = \frac{VC}{HC} / \frac{VK}{HK}$
33. Mass of water in mixture = water: cement ratio × mass of cement
34. Work done by effort in raising the load = effort × velocity ratio (VR)× load distance

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