higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T250**(E)**(M29)T

NATIONAL CERTIFICATE

BUILDING SCIENCE N3

(15070023)

29 March 2018 (X-Paper)
09:00–12:00

Nonprogrammable calculators and drawing instruments may be used.

This question paper consists of 7 pages and 1 formula sheet.

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. Rule off across the page on completion of each question.
5. ALL sketches and/or diagrams must be done in pencil.
6. Sketches must be neat, reasonably large, in proportion and fully labelled.
7. Assume that acceleration due to gravity *g* is 9,81 m/s^2.
8. Write down the formula before starting with calculations.
9. Write neatly and legibly.

QUESTION 1

Describe the process that you will follow to perform a slump test and illustrate by means of neat sketches the test and measure of a true slump. **[8]**

QUESTION 2

2.1 FIGURE 1 shows a simply supported beam carrying uniformly distributed loads varying in different beam segments.

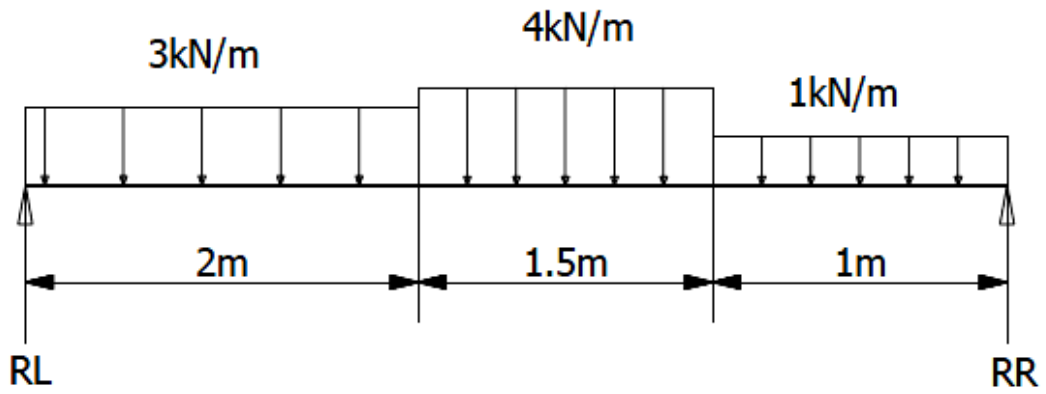

FIGURE 1

Calculate:

2.1.1 The magnitude of the reaction RL (3)

2.1.2 The magnitude of the reaction RR (3)

2.2 Draw a fully labelled shear force diagram to a linear scale of 1 cm : 0,5 m and a force scale of 0,5cm : 1 kN. (7)

2.3 Draw a fully labelled bending moment diagram to a linear scale of 1 cm : 0,5 m and a moment scale of 1 cm : 1 kNm. (7)
[20]

QUESTION 3

3.1 Give FOUR characteristics of a good fuse. (4)

3.2 Calculate the energy in joules developed when a heater with 3 ohm resistance has a current of 3 amperes flowing through it for 1 hour. (3)

3.3 If the heater described in QUESTION 3.2 is switched on daily for only 5 minutes, calculate the cost of energy at the end of 5 days if 1 kWh costs R1,35. (5)
[12]

QUESTION 4

4.1 Name FOUR plastic building products used in the construction industry. (4)

4.2 Calculate the velocity ratio, actual effort and mechanical advantage of a wheel and axle machine given the following specifications:

- Wheel diameter: 450 mm
- Axle diameter: 65 mm
- Efficiency: 95%
- Load: 400 N (6)

[10]

QUESTION 5

5.1 List FIVE qualities of a good paint. (5)

5.2 Explain the procedure for preparing and painting on newly galvanised sheet iron. (5)

[10]

QUESTION 6

FIGURE 2 shows a plane laminar.

Analytically determine the position of the centroid in relation to OM and ON respectively. Redraw TABLE 1 below in your ANSWER BOOK next to the question number and tabulate all your calculations and answers according to the table.
ALL dimensions on the laminar are in millimetres. NO marks will be awarded for using the graphical method.

HINT: Shape A is a rectangle.

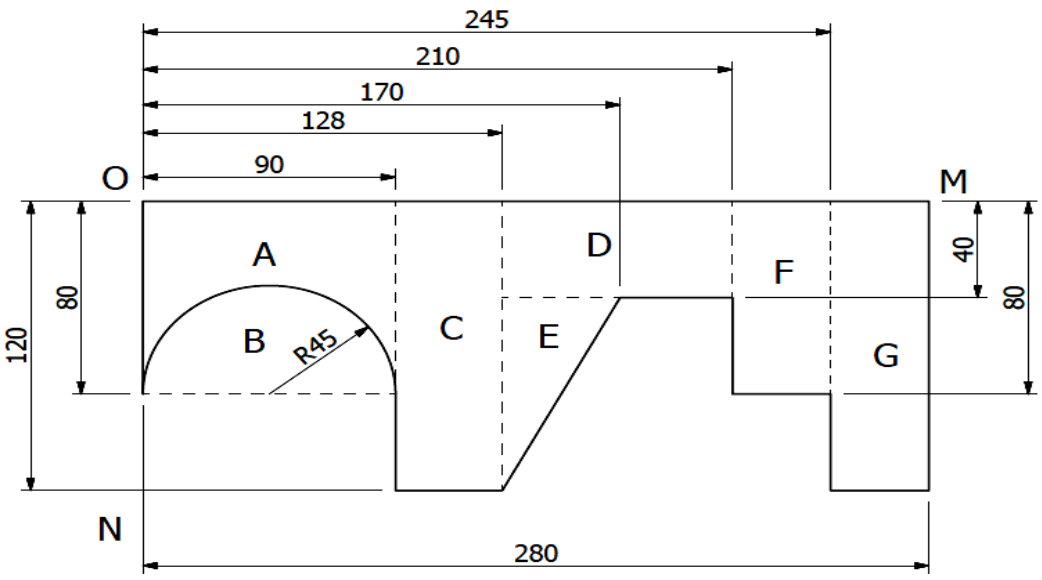

FIGURE 2

TABLE 1

SHAPE	AREA (mm^2)	ON (mm)	OM (mm)	A_{ON} (mm^3)	A_{OM} (mm^3)
A					
B					
C					
D					
E					
F					
G					
SUM					

[20]

QUESTION 7

FIGURE 3 below shows a simply supported framework.

7.1 Draw a fully labelled space diagram to a linear scale of 1 cm : 0,5 m and indicate the nature of the forces on the respective members. (2)

7.2 Calculate the magnitude of the reactions RL and RR respectively. (3)

7.3 Draw a force diagram to a scale of 1 cm : 2 kN. (4)

7.4 Reproduce TABLE 2 below next to the question number in the ANSWER BOOK and graphically determine the magnitude and nature of forces acting in each member of the force diagram. Tabulate the results as shown in TABLE 2. (11)

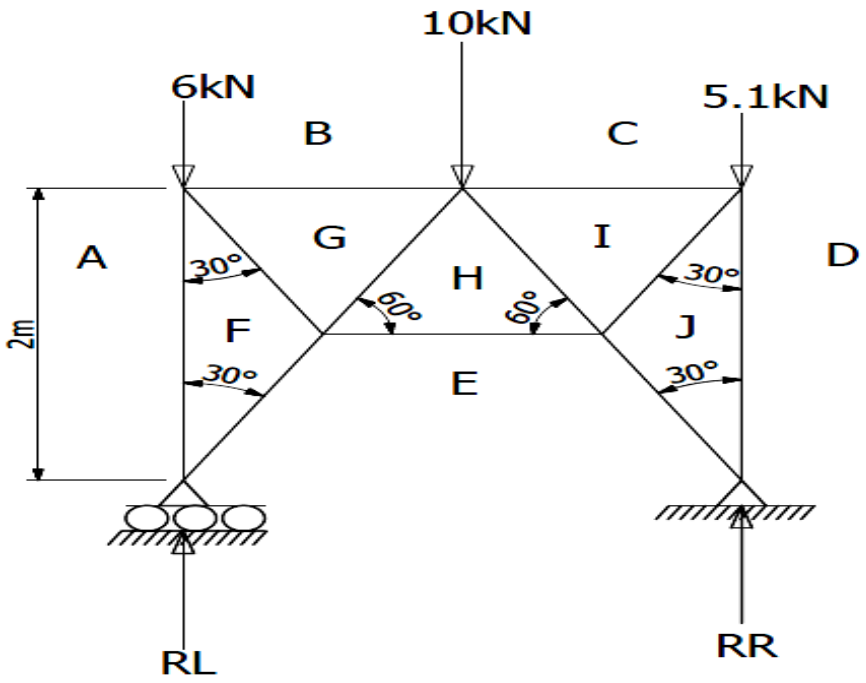

FIGURE 3

TABLE 2

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

[20]

TOTAL: 100

FORMULA SHEET

Any applicable formula may also be used.

1. $F = m \times g$
2. $A = \frac{\pi D^2}{4}$
3. $F = \mu \times W$
4. $\mu = \tan \emptyset$
5. Comp. // $= W \sin\emptyset$
6. Comp. $\perp = W \cos$
7. $F1 = \mu W \cos \emptyset + W \sin \emptyset$
8. $F\mu = \mu W \cos \emptyset$
9. $F2 = \mu W \cos \emptyset - W \sin \emptyset$
10. $s = ut + {}^{1}/_{2at^2}$
11. $v = u \pm 2\,as$
12. $v = u^2 \pm at$
13. $M = m\_ \times v$
14. $m \times u = m \times v$
15. $VR = \frac{Effort\ distance}{Load\ distance}$
16. $MA = \frac{Load}{Effort}$
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. $AV = F \times S$
24. $MOM = F \times \perp S$
25. $A = L \times B$
26. $A = \pi r^2$
27. $A = {}^{1}/_{2}\ bh\ /\ {}^{1}/_{2}\ ab\ sin\ C$
28. $A = 4\pi r^2$
29. $\bar{y} = \frac{4r}{3\pi}$
30. $\bar{x} = \frac{1}{3}h$
31. $R = \sqrt{HC^2 + VC^2}$
32. $TAN\emptyset = \frac{VC}{HC} / \frac{VK}{HK}$
33. Mass of water in mixture =
    water : cement ratio × mass of cement
34. Work done by effort in raising the load =
    effort × velocity ration (VR) × load distance
35. Compacting factor =
    $\frac{\text{Mass of partially compacted concrete}}{\text{Mass of fully compacted concrete}}$