higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

BUILDING SCIENCE N2

28 JULY 2021

This marking guideline consists of 7 pages.

QUESTION 1

1.1 The purpose of a roof is to protect✓ the structure of the building✓ and its contents from the elements of nature (rain, hail, sun and wind).✓ (3)

1.2
- sound proofing✓
- hail resistant✓
- water resistant✓
- influence of climate changes✓
- reflection and absorption of heat and cold✓
- cost✓
- attractiveness✓
- roof construction durability✓
- mass resistance to rust✓
- availability of materials ✓ (Any 5 correct answer) (5)

1.3 1.3.1 True✓ (1)

1.3.2 False✓ – One of the advantages✓ of Malthoid is inexpensive✓ (3)

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QUESTION 2

2.1 Take moments about R_R to calculate the magnitude of R_L

$\sum$ CW Moments = $\sum$ ACW Moments✓

$(R_L \times 8.5m) = (40kN \times 10m) + (15kN \times 8.5m) + (80kN \times 4m) + \{(17.5\ KN/m \times 4m) \times 2m\}$✓

$(R_L \times 8.5m) = 400\ kNm + 127.5\ kNm + 320\ kNm + 140\ kNm$✓

$R_L = \frac{987.5kNm}{8.5m}$✓

$R_L = 116.176\ kN$✓

OR

$\sum$ CW Moments = $\sum$ ACW Moments✓ ✓

$(R_L \times 8.5m) = (70kN \times 2m) + (80kN \times 4m) + (15KN \times 8.5m) + (40KN \times 10m)$

$R_L \times 8.5m = 140\ kNm + 320\ kNm + 127.5\ kNm + 400\ kNm$✓

$R_L = \frac{987.5kNm}{8.5m}$✓

$R_L = 116.176\ kN$✓ (5)

2.2 Take moments about R_L to calculate the magnitude of R_R

$\sum$ ACW Moments = $\sum$ CW Moments✓

$(R_R \times 8.5m) + (40kN \times 1.5m) = \{(17.5kNm \times 4m) \times 6.5m\} + (80kNm \times 4.5m) + (15kN \times 0m)$ ✓

$(R_R \times 8.5m) = 455kNm + 360kNm - 60kNm$✓

$R_R = \frac{755\ kNm}{8.5m}$✓

$R_R = 88.824\ kN$✓

OR

$\sum$ ACW Moments = $\sum$ CW Moments✓

$(R_R \times 8.5m) + (40kN \times 1.5m) = (80kN \times 4.5m) + (70kN \times 6.5m)$ ✓

$(R_R \times 8.5m) = 360kNm + 455kNm - 60kNm$✓

$R_R = \frac{755\ kNm}{8.5m}$✓

$R_R = 88.824\ kN$✓ (5)

2.3 Test the answer to prove equilibrium:

$\sum$ Upwards Forces = $\sum$ Downwards Forces

(116.176 kN + 88.824 kN)✓ = (40 kN + 15 kN + 80 kN + 70 kN)✓

205 kN = 205 kN✓ (3)

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QUESTION 3

3.1 3.1.1 Conduction refers to the gradual transfer✓ of heat from a hotter region✓ to a colder region.✓ (movement/transfer of heat from warm to cold) (3)

3.1.2 Convection is the transfer of heat✓ due to the movement✓ of heated particles which convey heat to the cooler particles.✓

OR

Transfer of heat✓ through mass movement✓ of a substance (substance could be air or water).✓ (3)

3.1.3 Radiation is the transfer of heat✓ through heat waves✓ or rays that travel through space.✓

OR

Radiation is energy in motion;✓ it can be the hot✓ rays of the sun.✓ (3)

3.2 3.2.1

$K = °C + 273$

$= 75\ °C + 273$✓

$= 348$✓

$75\ °C = 348\ K$✓ (3)

3.2.2

$°C = K - 273$

$= 330 - 273$✓

$= 57\ °C$✓

$57\ °C = 330\ K$✓ (3)

3.3 Heat loss = Heat gain

$M \times s.h.c \times \Delta t = M \times s.h.c \times \Delta t$

$7 \times 4\ 200 \times (90 - t_2) = 5 \times 4\ 200 \times (t_2 - 35)$✓

$2\ 646\ 000 - 29\ 400t_2 = 21\ 000t_2 - 735\ 000$

$21\ 000t_2 + 29\ 400t_2 = 2\ 646\ 000 + 735\ 000$✓

$50\ 400\ t_2 = 3\ 381\ 000$

$t_2 = \frac{3\ 381\ 000}{50\ 400}$✓

$t_2 = 67.083\ °C$✓✓

OR

(5)

$M \times s.h.c \times \Delta t = M \times s.h.c \times \Delta t$✓

$5 \times 4\,200 \times (35 - t_2) = 7 \times 4\,200 \times (t_2 - 90)$ ✓

$21000\,(35 - t_2) = 29400(t_2 - 90)$

$35 - t_2 = 1{,}4\,(t_2 - 90)$

$35 - t_2 = 1{,}4\,t_2 - 126$

$\frac{-2{,}4\,t_2}{-2{,}4} = \frac{-161}{-2{,}4}$ ✓

$t_2 = 67\,^0C$ ✓✓

[20]

QUESTION 4

4.1

MEMBER	4.1.1 AREA	4.1.2 DISTANCE (x-x)	4.1.3 MOMENTS
1	100 × 55 = 5500 mm²✓	50 mm✓	5500 mm² × 50 mm = 275 000 mm³✓
2	15 × 10 = -150 mm²✓	22.5 mm✓	150 mm² × 22.5 mm = -3 375 mm³✓
3	15 × 10 = -150 mm²✓	22.5 mm✓	150 mm² × 22.5 mm = -3 375 mm³✓
4	25 × 25 = -625 mm²✓	72.5 mm✓	625 mm² × 72.5 mm = -45 312.5 mm³✓
TOTALS	**= 4 575 mm²✓**		**= 222 937.5 mm³✓✓**
marks	(5)	(4)	(6)

(15)

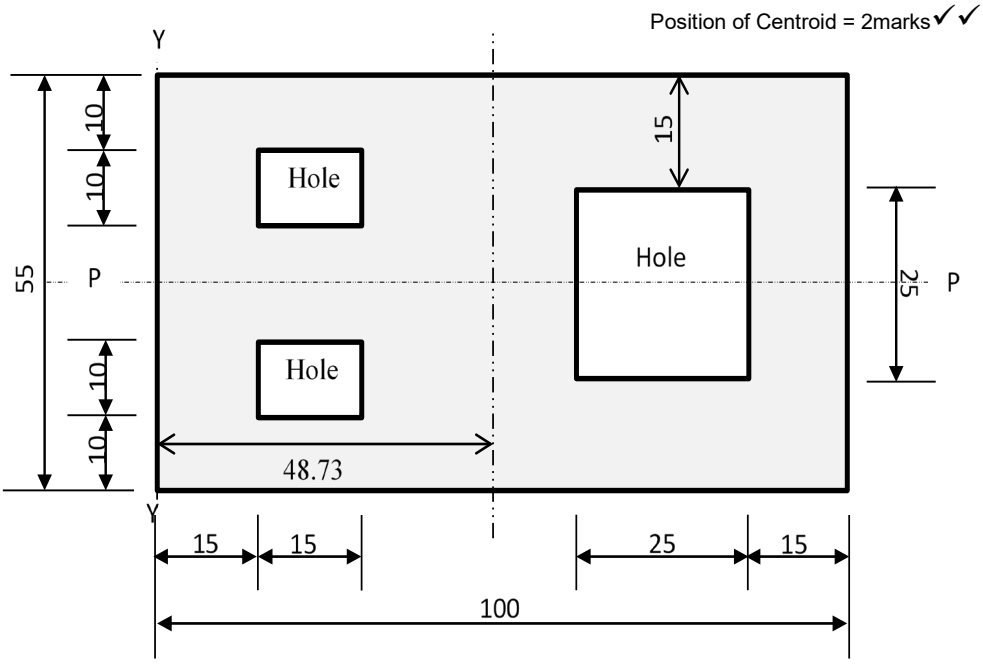
4.1.4 $\bar{y} = \frac{\sum \text{MOMENTS}}{\sum \text{AREA}}$ ✓

$\bar{y} = \frac{222\,937.5\ mm^3}{4\,575\ mm^2}$ ✓

$\bar{y} = 48.73$ mm 'X–X'✓✓ (4)

4.2

Space Diagram = 2 mark ✓✓
Position of Centroid = 2marks✓✓



(4)
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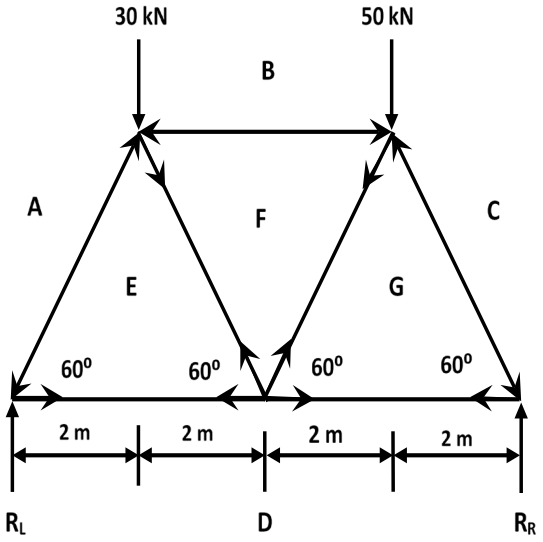
QUESTION 5

5.1 Tensile forces (Pulling forces) OR Contract force✓
Compressive forces (Pushing forces) OR Act on a distance force.✓ (2)

5.2 5.2.1

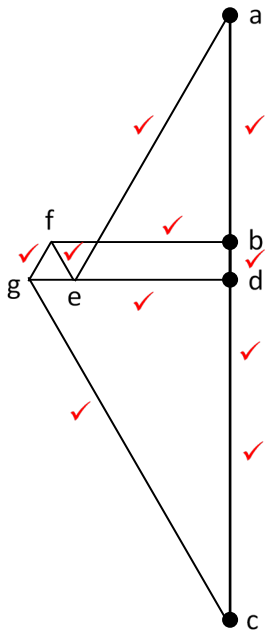
Space Diagram = 2 mark✓✓
Direction of members = 2marks✓✓



(4)

5.2.2

RL × 8 m = (50 × 2) + (30 × 6)
= 280/8
= 35KN✓
RR × 8 m = (30 × 2) + (50 × 6)
= 360/8
= 45 KN✓ (2)



(10 × ½) (5)

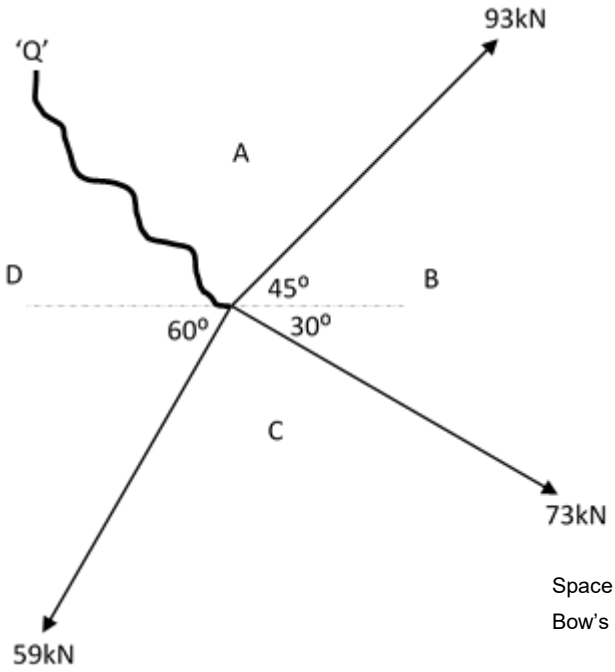
5.2.3

Member	Magnitude	Nature
AE	40kN✓	Strut✓
BF	23kN✓	Strut✓
CG	63kN✓	Strut✓
DE	21kN✓	Tie✓
EF	10kN✓	Tie✓
FG	10kN✓	Strut✓
DG	25kN✓	Tie✓

Any correct five (10 × ½) (5)
[18]

QUESTION 6

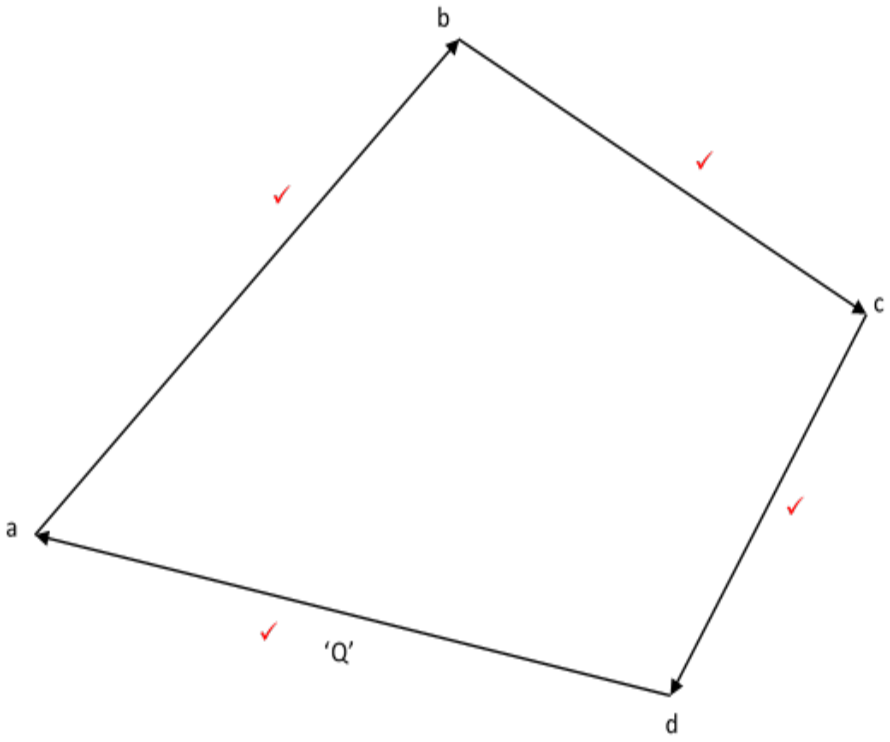
6.1 6.1.1



Space Diagram = 1 mark✓
Bow's notation = 2marks✓✓

(3)

6.1.2



'Q' = 103 kN✓✓ @ 11º✓ North of West✓

(8)

6.2 If three forces acting at a point✓ are in equilibrium, then the forces can be represented✓ in magnitude and direction of the sides of a triangle.✓ (3)

[14]

TOTAL: 100