



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

# **MARKING GUIDELINE**

**NATIONAL CERTIFICATE**

**APRIL EXAMINATION**

**BUILDING AND STRUCTURAL CONSTRUCTION N5**

**1 APRIL 2016**

**This marking guideline consists of 5 pages.**

**QUESTION 1: BOLT CONNECTION**

1.1 1.1.1 
$$\sigma_c = \frac{\text{Load}}{\text{Area}} = \frac{\text{Load}}{n \times \varnothing \times t}$$

$$= \frac{200 \times 10^3}{3 \times 12 \times 6}$$

$$= 925,9 \text{ MPa} \quad (4)$$

1.1.2 
$$\sigma_c = \frac{\text{Load}}{\text{Area}} = \frac{\text{load}}{n \times \varnothing \times t}$$

$$350 = \frac{85 \times 10^3}{3 \times \varnothing \times 6}$$

$$\varnothing = \frac{85 \times 10^3}{3 \times 350 \times 6}$$

$$= 13,492 \text{ mm}$$

Thus see; 16 mm bolts (4)

1.1.3 
$$\sigma_c = \frac{\text{Load}}{\text{Area}} = \frac{\text{Load}}{(B - nd) \times t}$$

$$\text{load (F)} = \sigma \times (B - nd) \times t$$

$$= 250 \times (122 \times 3 \times 18) \times 6$$

$$F = 102 \text{ kN} \quad (4)$$

- 1.2 This connection is not a safe method to connect 2 tie bars.  
 It should have 2 plates one on each side.  
 With one plate the connection is unbalanced and it will stretch/fail easier. (3)
- [15]**

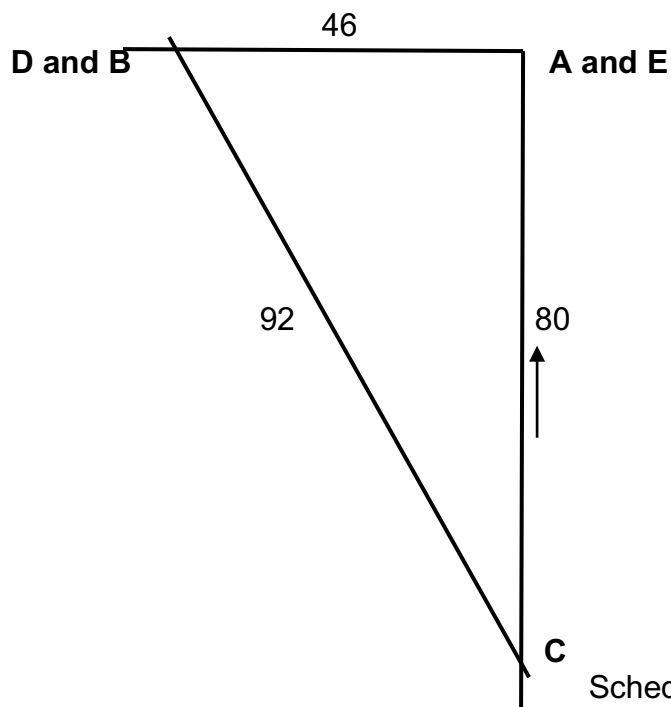
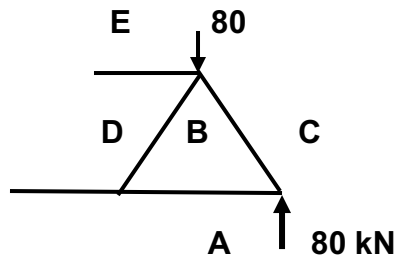
**QUESTION 2: FRAMES**

2.1 This is a symmetrical frame, thus  $L = R$  (no calculations needed)

Thus:  $R_L = 80 \text{ kN}$   
 $R_M = 80 + 80 = 160 \text{ kN}$   
 $R_R = 80 \text{ kN}$

(6)

2.2



(4)

MEMBER	MAGNITUDE	STUT OR TIE
AB	46	Tie (2)
BC	92	Strut (2)
BD	0	None (2)
DE	46	Strut (2)

(8)  
 [18]

**QUESTION 3: SECTION MODULES**

FIG	Area	Dist	A x Dist	$I_{xx} = \frac{bd^3}{12}$	Dist to NA	A x D <sup>2</sup>
1	5776	38	219488	2780181,333	38	8340544
2	-4624	38	-175712	-1781781,333	38	-6677056
3	5776	114	658464	2780181,333	38	8340544
4	-4624	114	-527136	-1781781,333	38	-6677056
	$\Sigma$ 2304		$\Sigma$ 175104	$\Sigma$ 1996800 $\sqrt{\sqrt{}}$	$\sqrt{}$	$\Sigma$ 3326976 $\sqrt{\sqrt{}}$

3.1  $\bar{Y} = 76 \text{ mm}$

This is a symmetrical figure:  $Y = 76 \text{ mm}$  (2)

3.2  $I_{xx} = \Sigma I_{xx} + \Sigma Ad^2$

$$I_{xx} = 1996800 + 3326976$$

$$= 5323776 \text{ mm}^4$$

$$I_{xx} = 5,324 \times 10^6 \text{ mm}^4 \quad (7)$$

3.3  $Z_e = \frac{I}{Y}$

$$Z_e = \frac{5,323776}{76}$$

$$Z_e = 70049,684 \quad (3)$$

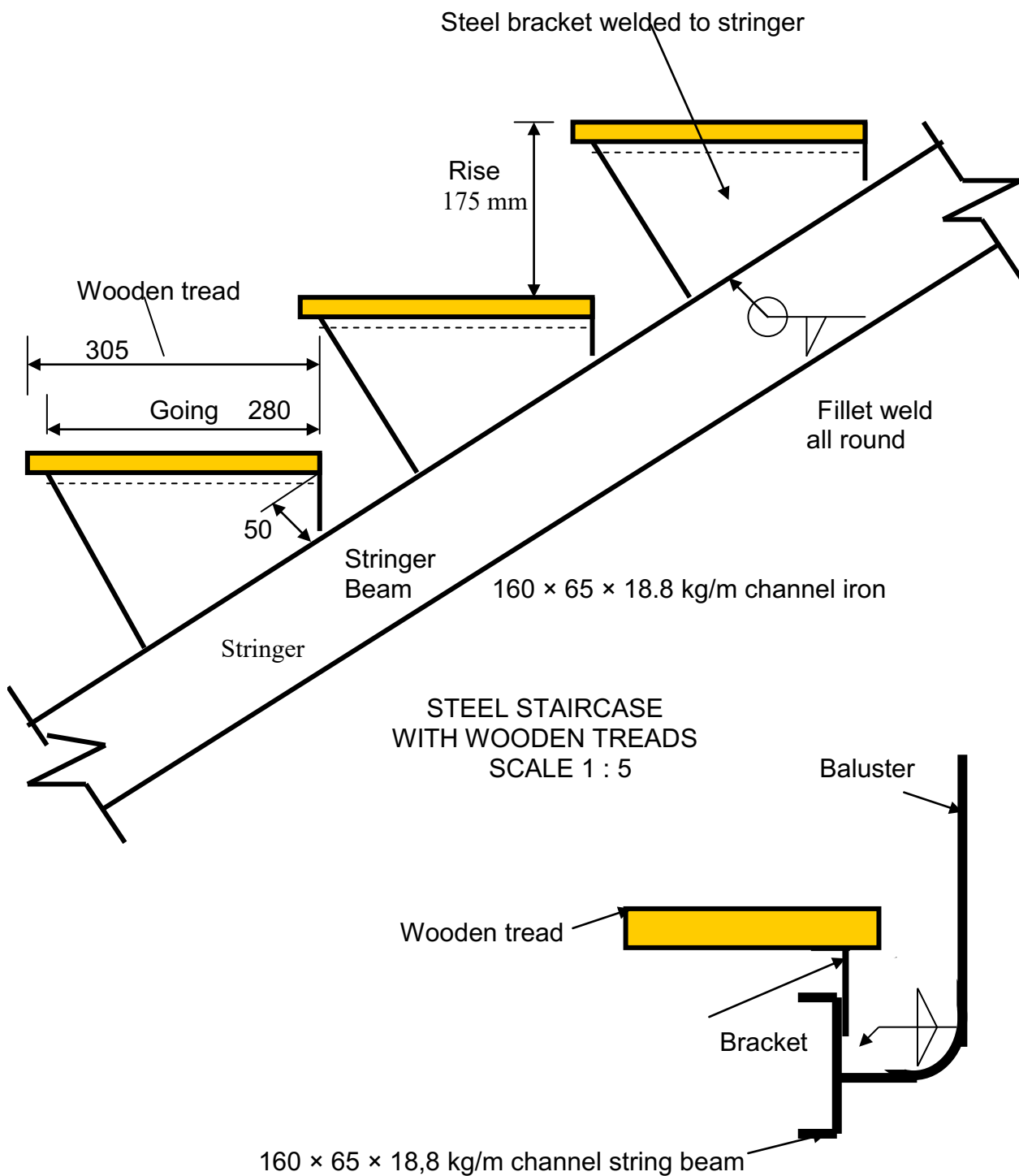
3.4  $BMo = \sigma \times Z_e$

$$BMo = 165 \times 70049,684$$

$$BMo = 11558,684,21 \text{ N/mm}^2 \quad (2)$$

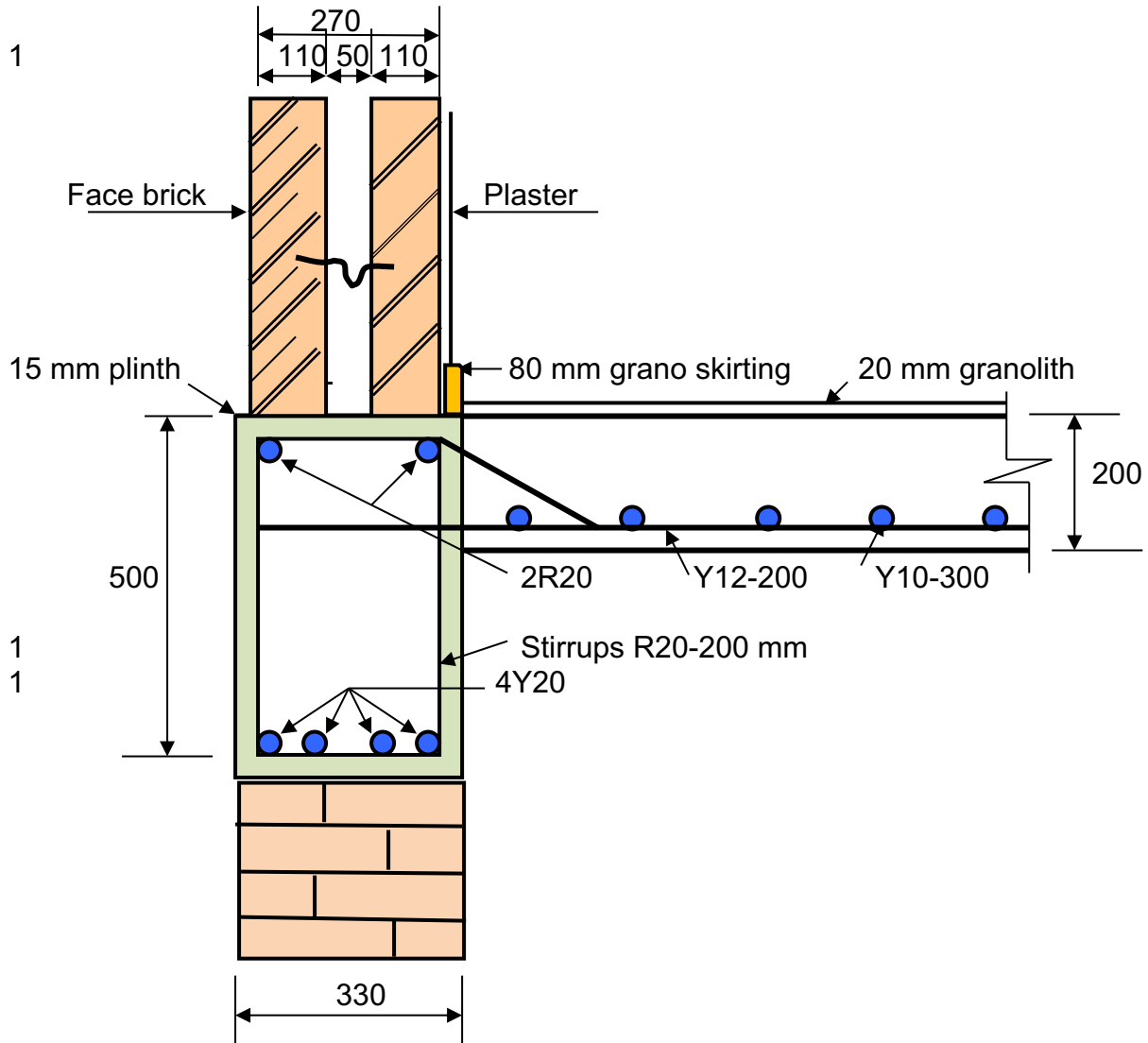
**[12]**

**QUESTION 4**



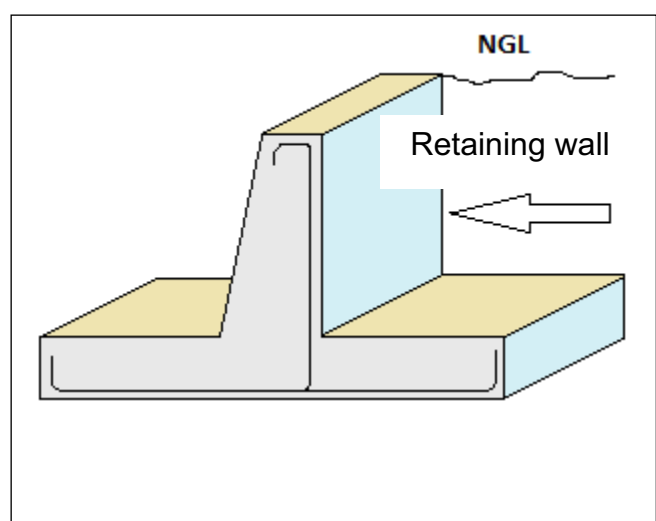
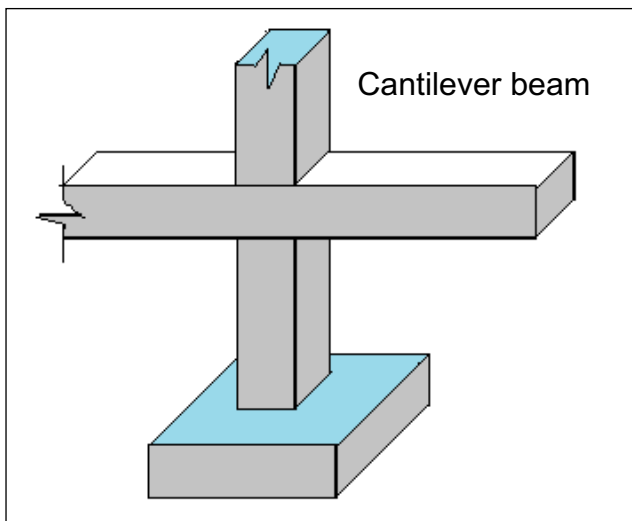
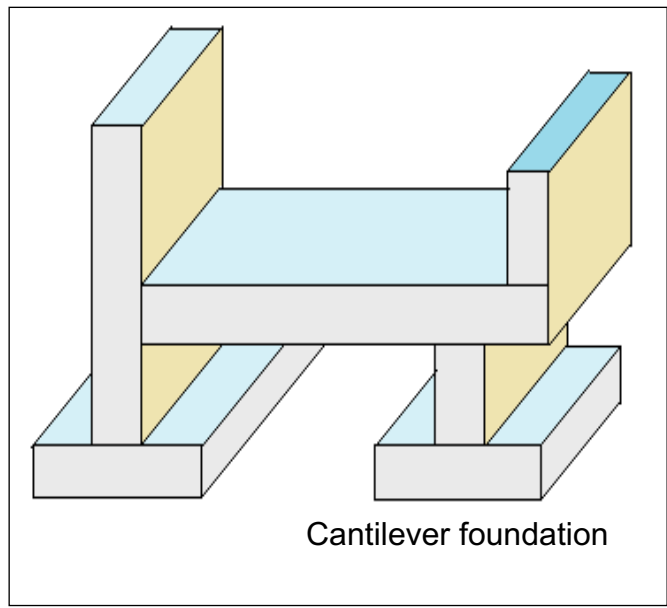
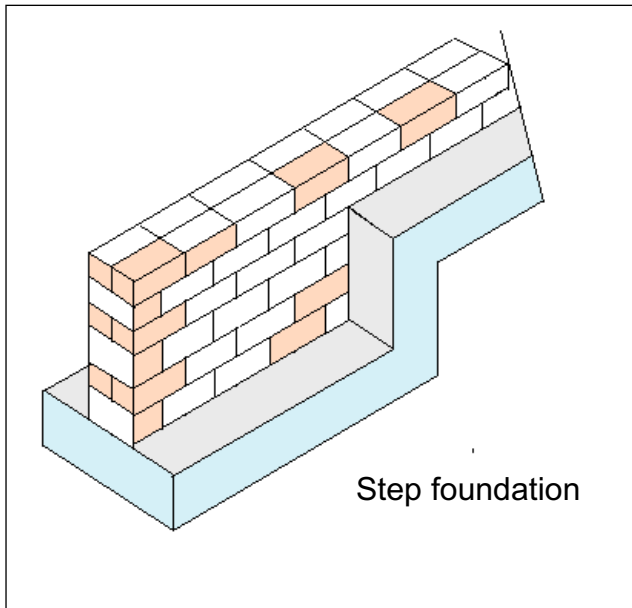
(12 + 8) [20]

QUESTION 5



[15]

**QUESTION 6**



(4 × 5) [20]

**TOTAL: 100**