CIVIL TECHNOLOGY
NOVEMBER 2016
MEMORANDUM

MARKS: 200

This memorandum consists of 16 pages.
QUESTION 1: CONSTRUCTION, SAFETY AND MATERIAL

1.1.1 The worker should have ensured that:

- the grinder and grinding blade/disc were inspected for defects before use.
- the angle grinder is used for the intended purpose only.
- correct blade is correctly fitted for the purpose.
- he/she is trained to use the machine correctly.
- do not force the tool.

ANY TWO OF THE ABOVE OR ANY OTHER ACCEPTABLE ANSWER  (2)

1.1.2

- Hard hat/safety helmet
- Safety goggles/goggles
- Overall
- Safety gloves/gloves

ANY TWO OF THE ABOVE  (2)

1.1.3 The machine makes a loud noise that will damage your hearing.

It is the rule or regulation on a building site to protect the hearing of workers.

ANY OF THE ABOVE  (2)

1.1.4

- dust mask
- face shield
- ear protection/ear plugs/ear muffs
- safety shoes

ANY ONE OF THE ABOVE  (1)

1.2  1.2.1

- Water
- Patent sealer
- Wet sand
- Hessian
- Canvas or protective covering
- Plastic sheeting
- Straw
- Waterproof paper

ANY ONE OF THE ABOVE  (1)

1.2.2  7 to 28 days
1.3

Single line for roof covering is acceptable.
Wall plate in good proportion acceptable.

**ASSESSMENT CRITERIA** | **MARK** | **CANDIDATE’S MARK**
--- | --- | ---
Roof covering correctly drawn | 1 | 
Beam filling correctly drawn | 2 | 
Wall plate correctly drawn | 1 | 
Any TWO labels | 2 | 
**TOTAL** | **6** | 

Single line for roof covering is acceptable.
Wall plate in good proportion acceptable.

1.4
• More battens are used ✓
• More roof trusses are used to carry weight of tiles ✓
• Clay/concrete tile more expensive than corrugated iron sheeting
• More labour intensive
• Needs roof underlay

ANY TWO OF THE ABOVE  

(2)

1.5
• Tiles /cladding✓
• Paint

ANY ONE OF THE ABOVE  

(1)

1.6
• Tiles last longer/easy to clean/ water resistant ✓
• Paint does not last as long as tiles, easy to clean.
• Tiles/paint gives attractive/decorative appearance.
• Protect plaster.

ANY ONE OF THE ABOVE  

(1)
1.7 1.7.1 Channel-iron/U beam ✓

1.7.2 Exposed steel is prone to rust if not treated. ✓

1.7.3 • Paint the metal. ✓
• Can be galvanised.
• Powder coating/ epoxy coating.
• Can be covered with oil.

ANY ONE OF THE ABOVE

1.7.4 • Channel iron is used for bracing or as joists. ✓
• Frame of steel structures/struts/roof structures

OR ANY OTHER ACCEPTABLE ANSWER
1.8  
1.8.1  
• Three quarter bat/brick  
• 165 mm x 110 mm. √
ANY ONE OF THE ABOVE

1.8.2

<p>| | | | |</p>
<table>
<thead>
<tr>
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<tbody>
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<td>A</td>
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<tr>
<td>A</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td>B</td>
</tr>
</tbody>
</table>

ASSESSMENT CRITERIA | MARK | CANDIDATE'S MARK
---------------------|------|-------------------
Stretcher course     | 2    |                   
Header course         | 1    |                   
Correctness of T-junction | 1  |                   
TOTAL                | 4    |                   

1.9  
• Cement fibre ceiling boards √
• Match board ceiling boards
• Steel ceilings
• Gypsum boards
• Knotty pine ceilings
• PVC/plastic/polystyrene ceilings
ANY ONE OF THE ABOVE

1.10  
• To allow excess water or damp to escape √
• keeping the inner wall dry
• Ventilation
ANY ONE OF THE ABOVE

[30]
QUESTION 2: ADVANCED CONSTRUCTION AND EQUIPMENT

2.1  2.1.1  D  ✓  (1)
     2.1.2  L  ✓  (1)
     2.1.3  J  ✓  (1)
     2.1.4  H  ✓  (1)
     2.1.5  K  ✓  (1)
     2.1.6  A  ✓  (1)
     2.1.7  M  ✓  (1)
     2.1.8  I  ✓  (1)
     2.1.9  G  ✓  (1)
     2.1.10 B ✓ (1)

2.2  2.2.1  Chalk line  ✓
      USE
      • To draw a straight line on a surface, by snapping the line. ✓
      • Lay out walls on foundation.
      • Some types can be used as a plumb bobs.
      • Draw long lines on floors.  (2)
      ANY TWO OF THE ABOVE

2.2.2  Try square  ✓
      USE
      • Marking lines perpendicular to surfaces of materials. ✓
      • Testing squareness, straightness.
      • Calibrated blade can be used for measuring.
      • As a straight edge to test whether small surfaces are flat and straight.  (2)
      ANY TWO OF THE ABOVE

2.2.3  Mitre square  ✓
      USE
      • The mitre can be used to check/end marks 45° angles. ✓
      • Test squareness of corners.
      • Test mitre angles and mark them.
      • Marking lines perpendicular to surfaces are flat and straight.
      • Testing squareness, straightness of surfaces.
      • Calibrated blade can be used for measuring.
      • As a straight edge to test whether surfaces of materials.  (2)
      ANY TWO OF THE ABOVE
2.2.4 Sliding bevel √
USE
- The blade is adjustable for setting out and testing of any angles. √
- Draw inclined or oblique lines as well as for the testing of angles.
- Draw angles other than 90˚
- Copying angles from one surface to another. (2)
ANY TWO OF THE ABOVE

2.3 2.3.1
- The tensile strength of the concrete is compromised. √
- Weakens the structure/ structure will break easily/ collapse. √
- Will not be able to resist heavy loads. (2)
ANY TWO OF THE ABOVE

2.3.2 To strengthen the concrete where it is the weakest against tensile strength. √ (1)

2.3.3 Stirrups strengthen concrete against shear forces. √
Shear forces are the greatest next to the support, Stirrups resist shear stress. (1)

2.4 2.4.1 Slump test √ (1)

2.4.2 This test is used to test the workability of concrete/ consistency of the concrete √ (1)

2.4.3 For every new/fresh batch of concrete that is mixed √ (1)

2.5
- Cavity walls are to prevent the penetration of water into the wall as they have better water proofing qualities. √
- Cavity walls help to protect the inner wall of a house against moisture. √
- Cavity walls provide insulation against extreme temperatures and noise.
- Avoid expensive external rendering.
- Enable the use of cheaper or alternative materials for the inner construction. (2)
ANY TWO OF THE ABOVE

2.6 2.6.1 A – Compression force/pushing forces √
B – Tensile force/bending forces √
C – Lateral force √ (3)

2.7 2.7.1 Round/circular/cylindrical column formwork √ (1)

2.7.2 Hardboard/plywood/pvc/galvanised/metal sheets √ (1)

2.7.3 Bolt and nut/threaded rods with nuts/clamp √ (1)
2.7.4 Apply form oil/emulsion oil/releasing agents to formwork √

2.8

- A rib and block floor is very quick to install √
- quicker than in situ concrete floor

ANY ONE OF THE ABOVE

2.9

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>MARK</th>
<th>CANDIDATE’S MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ribs</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Block</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Reinforcing on top of or in the rib</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hollow in block</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

(5) [40]
QUESTION 3: CIVIL SERVICES

3.1

P-trap
S-trap
Labelling not required

(2)

3.2
40/50 mm

(1)

3.3

3.3.1
A Ventilation pipe/breather pipe/gas escape pipe

(1)

B Inlet pipe/Inflow pipe/Influent

(1)

C Settling chamber/Chamber 1

(1)

D Discharge chamber/Chamber 2

(1)

E Manhole cover/Manhole lid/Cover

(1)

F Outlet pipe/Effluent

(1)

3.3.2
The raw sewerage will be broken down by anaerobic/bacterial action.

(1)

3.3.3
• G allows the liquids to flow from chamber C to chamber D.

(1)

• Will also balance the liquid levels.

ANY ONE OF THE ABOVE

3.3.4
The liquids in D will flow out through F to a French drain.

(1)

3.3.5
The level of the liquids will be the same.

(1)

3.3.6
• The water coming from the bath or sink contains soap (chemicals) that is poisonous to the bacteria and will hinder the anaerobic/bacterial process.

(1)

• It will fill up quicker if the French drain gets saturated.

ANY ONE OF THE ABOVE

3.4
Storm water systems are used to carry storm water to rivers or low-lying dams.

(1)

3.5
If you direct storm water into a sewerage system:

• the water will flood the reticulation plant.

• raw sewerage will overflow into rivers and pollute water sources.

• it is illegal to direct rain or storm water into a sewerage system.

ANY TWO OF THE ABOVE
3.6 Pressure control valves (pressure-reducing valves) are used to ensure that:
- a constant pressure is maintained in the water installation
- prevent pipes from bursting
- the pressure rating is in accordance with the pressure rating of the geyser.

**ANY ONE OF THE ABOVE**

3.7
- An elbow will be used to change the direction of a pipe
- A T-coupler will be used to split the water supply into two different flow directions/ to combine two different flow directions into one (shower).

**ANY TWO OF THE ABOVE**

3.8 Thermostat

3.9 Gravity geyser/Low pressure geyser

3.10 Black
- Absorbs the most heat
3.11

A: Wall light √
B: Power point/Socket outlet/Switch Socket outlet/Plug √

**ASSESSMENT CRITERIA**

<table>
<thead>
<tr>
<th>ASSESSMENT CRITERIA</th>
<th>MARK</th>
<th>CANDIDATE'S MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incoming cable to meter box</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Incoming cable to DB</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Meter box</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Distribution board</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4</strong></td>
<td></td>
</tr>
</tbody>
</table>

**ANY OTHER WAY OF INDICATING CONDUIT PIPES**

[30]
QUESTION 4: QUANTITIES, MATERIALS AND JOINING

4.1  4.1.1 Door stile \( J \)  (1)

4.1.2  50 mm/50 \( J \)  (1)

4.1.3  600 \( J \)  (1)

4.1.4  3 \( J \)  (1)

4.1.5  693 mm/693 \( J \)  (1)

4.1.6  1 907 mm/1 907 OR 1 904 mm/1 904 \( J \)  (1)

4.1.7  20 mm/20 \( J \)  (1)

4.2  4.2.1 B \( J \)  (1)

4.2.2 A \( J \)  (1)

4.2.3 D \( J \)  (1)

4.2.4 D \( J \)  (1)

4.2.5 A \( J \)  (1)

4.2.6 D \( J \)  (1)

4.2.7 C \( J \)  (1)
### 4.3.1

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th></th>
<th>B</th>
<th></th>
<th>C</th>
<th></th>
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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Area to be plastered:</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Length of ONE short wall:</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= 4 000 mm - 2(220 mm)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= 3 560 mm (\sqrt{\text{m}})</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td>Length of ONE long wall</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>= 8 000 mm - 2(220 mm)</td>
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<td></td>
<td></td>
<td></td>
<td>= 7 560 mm (\sqrt{\text{m}})</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Total length of one short and one long wall</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td></td>
<td>= 3 560 mm + 7 560 mm</td>
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<td></td>
<td>= 11 120 mm (\sqrt{\text{m}})</td>
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<td></td>
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<tr>
<td>2/</td>
<td></td>
<td></td>
<td>11,12</td>
<td></td>
<td></td>
<td>Area of internal walls before deductions:</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2,7 (\sqrt{\text{m}})</td>
<td></td>
<td></td>
<td>60,05 m² (\sqrt{\text{m}})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/</td>
<td></td>
<td></td>
<td>1,2</td>
<td></td>
<td></td>
<td>Area of window opening:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0,9 (\sqrt{\text{m}})</td>
<td></td>
<td></td>
<td>1,08 m² (\sqrt{\text{m}})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/</td>
<td></td>
<td></td>
<td>2,1</td>
<td></td>
<td></td>
<td>Area of door opening:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>0,9 (\sqrt{\text{m}})</td>
<td></td>
<td></td>
<td>1,89 m² (\sqrt{\text{m}})</td>
<td></td>
<td></td>
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<td></td>
<td>Total wall area to be plastered</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>(60,05 \text{m}^2 - 1,08 \text{m}^2 - 1,89 \text{m}^2)</td>
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<td></td>
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<td></td>
<td></td>
<td>= 57,08 m² (\sqrt{\text{m}}) need to be plastered</td>
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<td></td>
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#### 4.3.2

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<th></th>
<th></th>
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<th>Volume of plaster:</th>
<th></th>
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<tr>
<td>1/</td>
<td></td>
<td></td>
<td>57,08 m² (\sqrt{\text{m}})</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0,012 \text{m} \times 0,68 \text{m}^3 \sqrt{\text{m}})</td>
<td></td>
</tr>
</tbody>
</table>

If candidates did not use the dimension paper/sheet 2 marks should be deducted
QUESTION 5: APPLIED MECHANICS

5.1

5.1.1 675 mm² ✓

5.1.2 4800 mm² OR 4400 mm² ✓

5.1.3 400 mm² ✓

5.1.4 5075 mm² ✓

5.1.5 30 mm ✓

5.1.6 95 mm ✓ ✓

5.1.7 40 mm ✓

When the wrong unit were used the learner will be penalised with ONE mark.
5.2

**DIAGRAM A: SPACE DIAGRAM**

**DIAGRAM B: VECTOR DIAGRAM/FORCE DIAGRAM**

**NOT ACCORDING TO SCALE**

**USE A MASK TO MARK THIS QUESTION**

<table>
<thead>
<tr>
<th>MEMBER</th>
<th>NATURE</th>
<th>MAGNITUDE</th>
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<tbody>
<tr>
<td>BC</td>
<td>Strut</td>
<td>65 N (Size to be determined as per vector diagram) OR 0 OR no force</td>
</tr>
<tr>
<td>CD</td>
<td>Tie</td>
<td>----------</td>
</tr>
<tr>
<td>DA</td>
<td>Tie</td>
<td>32 N (Size to be determined as per vector diagram)</td>
</tr>
<tr>
<td>BD</td>
<td>Strut</td>
<td>----------</td>
</tr>
</tbody>
</table>

Tolerance of 1 N to either side
5.3.1

**SPACE DIAGRAM**

**SHEAR FORCE DIAGRAM**

**ASSESSMENT CRITERIA**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Marks</th>
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</thead>
<tbody>
<tr>
<td>Drawing correct</td>
<td>5</td>
</tr>
<tr>
<td>Indicate all values of shear forces on drawing</td>
<td>1</td>
</tr>
<tr>
<td>Correct application of scale</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

5.3.2 Calculated from the left:

\[
BM_d: = (28 \times 6) - (10 \times 4) - (20 \times 1) \sqrt{\ }
\]

\[
= 168 - 40 - 20 \sqrt{\ }
\]

\[
= 108 \text{ Nm} \sqrt{\ }
\]

**OR**

Calculated from the right:

\[
BM_d: = (42 \times 4) - (20 \times 2) - (20 \times 1)
\]

\[
= 168 - 40 - 20
\]

\[
= 108 \text{ Nm}
\]

(3) [30]
ANSWER SHEET 6.1

<table>
<thead>
<tr>
<th>NO.</th>
<th>QUESTIONS</th>
<th>ANSWERS</th>
<th>MARKS</th>
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<tbody>
<tr>
<td>1</td>
<td>Name the scale used for the site plan.</td>
<td>1:200 √</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>State the colour that you will use to indicate the proposed dwelling on the site plan.</td>
<td>Red √</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Identify number 1?</td>
<td>Rodding eye √</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Identify the line at number 2?</td>
<td>Building line √</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Identify number 3</td>
<td>Sewer pipe/drainpipe √</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Determine the distance from the boundary line to the proposed dwelling on the right hand side of the building?</td>
<td>5 000 mm/5 m √</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Identify number 4</td>
<td>Manhole √</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Identify number 5</td>
<td>Municipal connection √</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Draw the roofline of a hipped roof for the building indicated in the next column</td>
<td><img src="image.png" alt="Diagram" /></td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>Calculate the perimeter of the proposed dwelling.</td>
<td>64 000 mm/64 m √</td>
<td>2</td>
</tr>
<tr>
<td>11</td>
<td>What elevation will be closest to Long Street?</td>
<td>West elevation √</td>
<td>1</td>
</tr>
</tbody>
</table>

TOTAL 15
QUESTION 6: GRAPHICS AND COMMUNICATION

ANSWER SHEET 6.2

ASSESSMENT CRITERIA | MARKS | LM
---|---|---
External Walls | 4 |
Internal Walls | 3 |
Windows | 3 |
Doors | 3 |
Wash basin | 1 |
Water closet | 1 |
Double bowl sink | 1 |
Dimensions | 4 |
Floor coverings | 2 |
Application of scale
One or two incorrect | 3 |
Three or four incorrect | 2 |
More than five incorrect | 1 |
No measurement correct | 0 |
TOTAL | 25 |

NOT TO SCALE: USE A MASK TO MARK THIS QUESTION
ONE MARK SHOULD BE DEDUCTED IF JUNCTIONS AT WALLS ARE CLOSED
ONE MARK SHOULD BE DEDUCTED IF INTERNAL DOORS HAVE A WALL BETWEEN THE OPENING

Application of scale √√