6720-550 MARCH 2018
Level 3 Advanced Technical Extended Diploma in Constructing the Built Environment (Civil Engineering) (720)
Level 3 Constructing the Built Environment – Theory Exam

Friday 23 March 2018
09:30 – 11:30

Candidate name (first, last)
First
Last
Candidate enrolment number
Date of birth (DDMMYYYY)
Gender (M/F)
Assessment date (DDMMYYYY)
Centre number
Candidate signature and declaration*

• If any additional answer sheets are used, enter the additional number of pages in this box.
• Please ensure that you staple additional answer sheets to the back of this answer booklet, clearly labelling them with your full name, enrolment number, centre number and qualification number in BLOCK CAPITALS.
• All candidates need to use a black/blue pen. Do not use a pencil or gel pen.
• If provided with source documents, these documents will not be returned to City & Guilds, and will be shredded. Do not write on the source documents.

*I declare that I had no prior knowledge of the questions in this assessment and that I will not divulge to any person any information about the questions.

You should have the following for this examination
• a pen with blue or black ink
• a pencil
• a ruler
• a non-programmable calculator

General instructions
This question paper is the property of City and Guilds of London and should be returned after the examination.
• This examination contains 15 questions. Answer all questions.
  • Answer the questions in the space provided.
  • The marks for each question are shown in brackets.
  • Show all calculations.
1 a) Define the term triangulation as used in surveying. (2 marks)

b) Define GIS as used in surveying. (2 marks)

2 Describe the purpose of a TBM in surveying. (2 marks)

3 Explain one reason why a site surveyor might choose to use a total station to perform a land survey. (2 marks)
A new sewer is to be excavated between two manholes. The trench width for the new sewer is to be 600 mm. The depths of excavation from the existing ground levels to the proposed formation levels of the sewer are shown below in Table 1.

<table>
<thead>
<tr>
<th>Chainage (m)</th>
<th>Depth of excavation to formation level (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH 1·Chainage 0</td>
<td>1.3</td>
</tr>
<tr>
<td>10</td>
<td>1.45</td>
</tr>
<tr>
<td>20</td>
<td>1.6</td>
</tr>
<tr>
<td>30</td>
<td>1.65</td>
</tr>
<tr>
<td>40</td>
<td>1.7</td>
</tr>
<tr>
<td>50</td>
<td>1.8</td>
</tr>
<tr>
<td>60</td>
<td>1.6</td>
</tr>
<tr>
<td>70</td>
<td>1.65</td>
</tr>
<tr>
<td>MH 2·Chainage 80</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Table 1

Determine, using Simpson’s Rule shown below, the volume of spoil to be removed. (4 marks)

Simpson’s Rule: Area = \[
\frac{w}{3} \left( y_1 + y_n + 4(y_2 + y_4 + \ldots) + 2(y_3 + y_5 + \ldots) \right)
\]
5. State the technical term used for loads that are
a) concentrated at one place
b) spread out over an area.

6. For the simply supported beam shown in Figure 1:

a) Determine the bending moment (BM) values at points A and B.

b) Produce a BM diagram for the beam.

7. State the meaning of three of the terms of the bending theory equation shown below.

$$\frac{M}{T} = \frac{I}{y}$$

M =

f =

I =
8 State the units for:
   a) first moment of area (1 mark)
   b) second moment of area. (1 mark)

9 With reference to the section shown in Figure 2:
   a) Calculate the moment of inertia about the x-x axis. (4 marks)
   b) Determine the moment of resistance of the beam, if the maximum bending stress in either tension or compression is 165 N/mm². (3 marks)
10 An excavation is to take place on a site with a foundation of depth 1.5 m. A site investigation has confirmed the presence of gas pipes in the ground.

a) Identify one risk associated with the gas pipe to those working on site. (1 mark)

b) Identify one control measure to minimize the risk. (1 mark)

11 Name the four components of the flexible highway construction shown in Figure 3. (4 marks)

12 Explain one disadvantage of a rigid highway construction form. (2 marks)
13 A fast food chain intends to build a number of new outlets. These outlets will have a pre-fabricated structural steel frame and will be delivered to the site ready for erection.
   a) Name two items of health and safety legislation which should be applied during the design and construction phases of the project. (2 marks)

   b) Explain why a pre-fabricated structural steel frame has been specified for the outlets. (4 marks)

14 Explain why a pile foundation would be preferred to a strip foundation for the construction of a low-rise commercial building. (4 marks)
A developer has planning permission for a three-storey office block. This is to be built from concrete cast in situ. The new building will be rectangular and have plan dimensions of 85 m x 25 m.

a) Explain how the datum is transferred from an Ordnance Survey Bench Mark (OSBM) to Temporary Bench Marks (TBMs) on the four corners of the site. (3 marks)

b) Discuss how the decision to use concrete, cast in situ, will affect the design and construction of the structure. (9 marks)