# 6720-556 MARCH 2018

Level 3 Advanced Technical Extended Diploma in Constructing the Built Environment (Civil Engineering) (1080)

Level 3 Constructing the Built Environment – Theory Exam

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<th>Assessment date (DDMMYYYY)</th>
<th>Centre number</th>
<th>Candidate signature and declaration*</th>
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• 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.

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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 18 questions. Answer all questions.
  ◦ Answer the questions in the space provided.
  ◦ The marks for each question are shown in brackets.
  ◦ Show all calculations.
1. State the technical term used for loads that are
   a) concentrated at one place
   b) spread out over an area.

2. 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.

3. State the meaning of four of the terms of the bending theory equation shown below.

\[
\frac{M}{T} = \frac{I}{y}
\]

M = 

f = 

I = 

y = 
4  State the units for:
   a) first moment of area  
      
   b) second moment of area.  

5  With reference to the section shown in Figure 2:

   a) Calculate the moment of inertia about the x-x axis.  
      
   b) Determine the moment of resistance of the beam, if the maximum bending stress 
      in either tension or compression is 165 N/mm². 
      You should indicate the correct units.
6. An excavation is to take place on a site of 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)

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

   Figure 3

   i) ____________________________

   ii) ____________________________

   iii) ____________________________

   iv) ____________________________

8. Explain the disadvantages of a rigid highway construction form. (3 marks)

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________

   ________________________________________________________________
9 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 three items of health and safety legislation which should be applied during the design and construction phases of the project. (3 marks)

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

10 Explain why a pile foundation would be preferred to a strip foundation for the construction of a low-rise commercial building. (4 marks)

11 a) Identify two different drawings used when designing a new building. (2 marks)

b) Identify two different types of arch. (2 marks)
12 State which piece of equipment, when used with a pen and pencil, is best suited to the following manual drawing tasks:
   a) Drawing smooth lines of varying radii.  
      (1 mark)
   b) Axonometric drawings.  
      (1 mark)
   c) Creation of parallel horizontal lines.  
      (1 mark)
   d) Finding the centre of a line without measuring.  
      (1 mark)

13 Evaluate the core activities, associated to the BIM overlay, in relation to the following stages of the RIBA plan of works:
   a) Design (C, D & E).  
      (6 marks)
   b) Construction (J & K).  
      (2 marks)
14 a) Define the term 'standard deviation'.

b) State the relationship between standard deviation and variance.

c) Describe what is meant by the term ‘grouped data’.

15 a) Which calculus technique is used to determine a turning point on a curve?

b) Determine, by integration, the area enclosed by the curve $y = 3x^2 + 4$, the x-axis and the ordinates $x = 0$ and $x = 3$. 
16 Evaluate \((1-0.03)^6\), correct to \textbf{three} decimal places, using the binomial expansion theorem.

The binomial expansion theorem is \((1 + x)^n = 1 + \frac{nx}{1!} + \frac{n(n-1)x^2}{2!} + \ldots\) (4 marks)

17 Concrete cubes were tested for compressive strength during concrete pours on two construction sites. The specified compressive strength of the concrete was 30 N/mm² in both cases.

The test results for each site were:

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<th>Site</th>
<th>Median Strength (N/mm²)</th>
<th>Interquartile range (N/mm²)</th>
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<tr>
<td>1</td>
<td>31.3</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>3</td>
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Explain how the data shown above should be interpreted. (2 marks)
A developer has planning permission for a three-storey office block. This is to be built from concrete cast in situ frame. The new building will be rectangular and have plan dimensions of 85 m x 25 m.

a) Explain how the effective length of a column affects its design. (3 marks)

b) Produce one sketch of a junction detail in the concrete in situ frame. (3 marks)
c) Discuss, in terms of the structural considerations, the reasons why concrete cast in situ has been selected. (12 marks)