6 7 2 0 5 5 6 0 6 1 8

City & Guilds

6720-556 JUNE 2018
Level 3 Advanced Technical Extended Diploma in Constructing the Built Environment (Civil Engineering) (1080)

Level 3 Constructing the Built Environment – Theory exam

If provided, stick your candidate barcode label here.

Friday 22 June 2018
09:30 – 12:30

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. ➡ 0 0
- 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

- non-programmable scientific calculator
- a pen with blue or black ink
- a pencil and ruler

General instructions

This question paper is the property of City and Guilds of London and should be returned after the examination.

- This examination contains **25** questions. Answer **all** questions.
  - Answer the questions in the space provided.
  - The marks for **each** question are shown in brackets.
- Show **all** calculations.

ST00052732 A3 PO4500134161 10366617

1 Identify **two** of the laws of static equilibrium used to determine beam reactions. (2 marks)

2 For the cantilever beam shown in Figure 1.

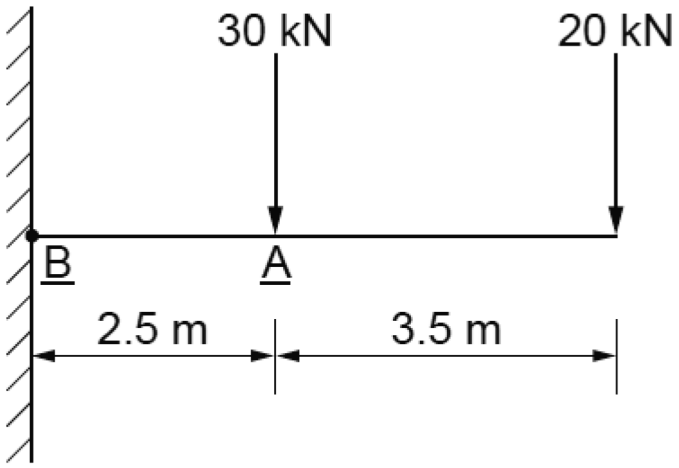

Figure 1

a) Determine the bending moment values at points A and B. (2 marks)

b) Produce a bending moment diagram to represent the loading. (2 marks)

3 Describe **one** effect that eccentric loading has on columns. (2 marks)

4 Determine the safe axial-load for a timber post that is 75 mm square and which has an effective length of 2.5 m, using the table below. You must show **all** calculations. (4 marks)

Slenderness ratio (L/b)	Permissible stress (N/mm^2)
30	8.7
40	11.5

5 State the following modes of failure for a retaining wall.

a) Overturning. (1 mark)

b) Sliding. (1 mark)

See next page

6 A retaining wall retains water of density 10 kN/m^3. The height of the wall is 4.5 m.

a) Determine the pressure per linear metre at the base of the wall. (1 mark)

b) Calculate the magnitude of the total force per metre run (F_h) acting on the wall. (2 marks)

c) Calculate the height above the base of the wall at which the resultant force will act. (1 mark)

7 Name **two** methods used to determine forces in statically determinate frameworks. (2 marks)

8 Name **two** temporary methods of groundwater control that can be used on construction sites. (2 marks)

9 Name **two** items of earthworks plant used on construction sites. (2 marks)

10 Describe the purpose of a contraction joint used in rigid pavements. (2 marks)

11 State **three** duties under the Health & Safety at Work Act (HASWA) that **employees** must follow. (3 marks)

12 Explain the advantages of using a caisson as a method of deep excavation for bridge piers. (3 marks)

13 A retail company is planning to build a large new distribution warehouse.

Explain why a steel portal frame may be considered the **best** design option for the building. (3 marks)

See next page

14 A developer is keen to incorporate a sustainable urban drainage system (SUDS) into a new eco-village development and is seeking local public opinion on the design of the SUDS.

Evaluate the design considerations the local public may require the developer to consider. (5 marks)

15 Identify **two** methods used for the manual production of 3D drawings. (2 marks)

16 Describe what is meant by the term 'COBie'. (4 marks)

17 Identify **two** CAD software packages **most** appropriate to produce 3D models of a building. (2 marks)

18 Explain the challenges for BIM implementation. (4 marks)

19 Summarise the implications for the adoption of a totally digital drawing office. (4 marks)

20 State the calculus technique that can be used to determine

a) the area under a curve (1 mark)

b) the maximum and minimum turning points of a curve. (1 mark)

See next page

21 Concrete cube samples have been tested for strength on two separate construction sites. Cumulative frequency diagrams would normally be produced to show the test results taken from each site.

State which mathematical measure of dispersion, of a typical cumulative frequency diagram, should be used to identify the following.

a) The site with the concrete of greater strength. (1 mark)

b) The site with the least variance of strength between the samples of concrete. (1 mark)

22 Describe, with the aid of a diagram, the meaning of the term 'normal distribution' as used in statistical analysis techniques. (2 marks)

23 For the beam section shown in Figure 2.

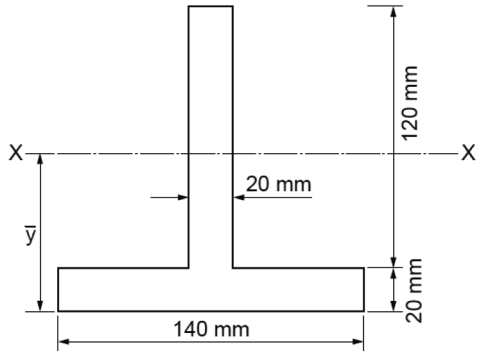

Figure 2

a) Calculate, using the first moment of area principles, the position of the centroidal axis X-X. (2 marks)

b) Calculate the second moment of area (moment of inertia) about the X-X axis. You may use the table below to complete your calculations. (5 marks)

Given $y = \frac{\sum (A_1 y_1 + A_2 y_2)}{\sum (A_1 + A_2)}$ $I_{CG} = bd^3/12$ $I_{XX} = I_{CG} + Ac^2$

Part	A mm^2	$\frac{bd^3}{12}$	c	Ac^2
1				
2				
Total				

See next page

24 Differentiate with respect to x

a) $y = 3x^4$ (1 mark)

b) $y = 5x^3 - 2x^2 + 10$ (2 marks)

25 A property developer has planning permission to build a large two-storey steel frame sports complex. The new building will be rectangular and have plan dimensions of 80 m x 20 m.

a) Explain how the bending theory equation is used and applied to design steel beams. (3 marks)

b) Produce a sketch or diagram showing elements of the foundation, columns, beams and floor sections of the steel frame. (3 marks)

c) Discuss the structural and design issues that will need to be considered for the steel frame. (12 marks)

End of examination