[ENG10]

# UNIVERSITY OF BOLTON

# SCHOOL OF ENGINEERING

# BSC (HONS) CONSTRUCTION MANAGEMENT

# SEMESTER TWO EXAMINATIONS 2021/2022

# PROJECT FINANCE

# MODULE NO: CAS5019

**Date: Thursday 19th May 2022** **Time: 14:00 – 16:00**

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**INSTRUCTIONS TO CANDIDATES:**

**This exam paper contains TWO SECTIONS: section 'A' and section 'B'**

**Section A: contains ONE COMPULSORY question. You must answer this question. It is worth 40 marks.**

**Section B: contains THREE questions: you should answer ANY TWO questions from these three questions. Each of these questions is worth 30 marks.**

**Marks for parts of questions are shown in brackets.**

**This examination paper carries a total of 100 marks.**

**All working must be shown.**

**A formula sheet is included.**

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## Section A – COMPULSORY Question (You Must Answer This Question)

### Question One

**Figure Q1.1** & **Figure Q1.2** show drawings (not to scale) of a plan and cross-section of a concrete storm tank proposed by a water company as relief for combined sewer overflow in urban catchment. The tank is built on a square concrete foundation of 0.8m thick. All dimensions in the Figures are in metres.

(a) Estimate in detail the quantities of the following items of work:

(i) Excavated soil **(10 marks)**

(ii) Concreting in the foundation **(10 marks)**

(iii) Concreting in the tank 0.6m thick wall **(10 marks)**

(b) Estimate the cost of each task if the unit rate of concrete in the foundation is £250/$m^3$, and in the tank wall is £275/$m^3$ and excavation of 1 $m^3$ of soil costs £20. **(10 marks)**

Prepare your quantities and cost in the standard tabular format.

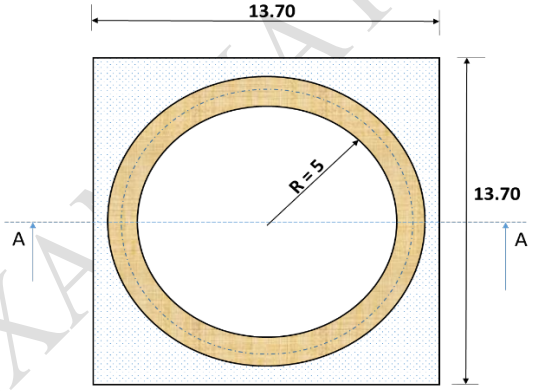


Figure Q1.1 Storm Tank Plan

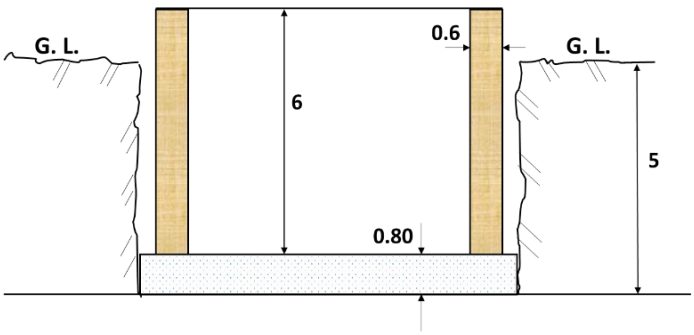


Figure Q1.2 Section A-A

**Total 40 marks**

**END OF SECTION A**

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## Section B – Optional Questions (Answer ANY TWO Questions)

### Question Two

The activities involved in the construction of a road project are given in **Table Q2.1** together with their estimated durations, logical sequence and cost. Each of the activities will be done using a separate gang. At the end of day 10 from the start of the project, the actual work status report is shown in **Table Q2.2**.

For this project, complete the following tasks:

(a) Draw the project Bar Chart as a planning or programming tool **(10 marks)**

(b) Develop the project Baseline Budget curve (S-Curve) **(10 marks)**

(c) Using the Earned Value Management (EVM) technique, check whether the project is on track cost wise and schedule wise. **(10 marks)**

**Total 30 marks**

| Activity | Predecessor | Duration (Day) | Cost/Day (£/Day) | Total Cost (£) |
|---|---|---|---|---|
| A | – | 6 | 300 | 1800 |
| B | – | 2 | 350 | 700 |
| C | A | 8 | 450 | 3600 |
| D | A, B | 5 | 250 | 1250 |
| E | B | 3 | 400 | 1200 |
| F | D, E | 6 | 300 | 1800 |

**Table Q2.1**

| Activity | Actual % Complete | Actual Cost (£) |
|---|---|---|
| A | 100 | 2000 |
| B | 100 | 1000 |
| C | 30 | 1800 |
| D | 80 | 1300 |
| E | 100 | 1350 |
| F | 0 | 0 |

**Table Q2.2**



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## Question Three

(a) Using the following information to calculate the net unit rate for:

(i) half brick thick skins of hollow walls built entirely of facing bricks in coloured mortar (1:1:6) and pointed with a flush joint - (using directly employed labour)

**(10 marks)**

(ii) 100 mm lightweight block wall in natural mortar (1:1:6) to receive plasterboard and skim

**(10 marks)**

**Materials**

Facing bricks £520 per 1000 delivered and off-loaded, waste 5%

100 mm lightweight blocks £9.98 per $m^2$, waste 5%

Pre-mix coloured mortar (1:1:6) £156.13 per $m^3$

Pre-mix natural mortar (1:1:6) £108.19 per $m^3$

For each half brick thickness of wall allow 0.02$m^3$ of mortar per $m^2$ of wall, plus waste 7.5%

For 100 mm block allow 0.007$m^3$ of mortar per $m^2$ of wall, plus waste 7.5%

**Directly employed labour costs**

Bricklayers £19.45 per hour. Labourers £15.89 per hour

Bricklayers work in 2 + 1 gangs

One bricklayer will lay 32 bricks per hour, pointed one side

One bricklayer will lay 2.7 $m^2$ blocks per hour

(b) Mindful of the current economic climate, discuss the risks to be considered by consultants OR contractors and their supply chains when bidding for construction work.

**(10 marks)**

**Total 30 marks**

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## Question Four

(a) Discuss the concept of plinth area as a method for rough estimation in the construction industry and assess its accuracy.

**(10 marks)**

(b) Prepare a Rough-cost Estimate based on unit costs of per unit plinth area basis of a four storeyed office building having a carpet area of 2000 sq. m. for obtaining the administrative approval of the Government. It may be assumed that the corridors, verandas, lavatories, staircase, etc. will take 30 % of the built up area and 10 % of built up area will be occupied by walls.

The following data is given:

- Plinth Area Rate = £ 150 / sq. m.
- Extra for special architectural treatment = 0.5 % of the building cost.
- Extra for water supply and sanitary installations = 6 % of the building cost.
- Extra for internal installations = 14 % of the building cost
- Extra for electric services = 12.5 % of building cost
- Extra for gas services = 6 % of building cost
- Extra due to deep foundations at site = 1.0 % of building cost
- Contingencies = 2.5 % overall
- Supervision charges = 8 % overall
- Design charges = 2.5 % overall

**(20 marks)**

**Total 30 marks**

**END OF QUESTIONS**



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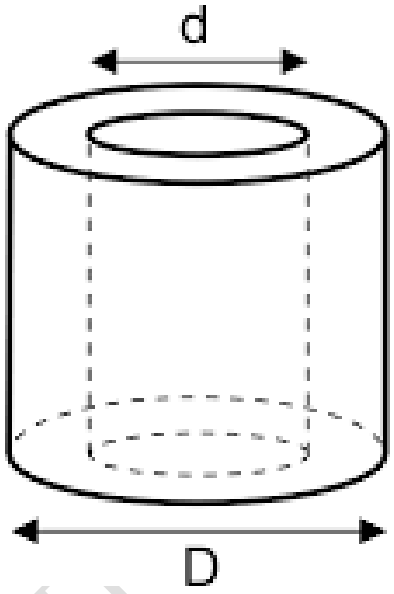
## Useful Formulae

$$V = \pi \cdot h \cdot (D^2 - d^2) / 4$$




Plinth area = Carpet Area of the building + size of the walls (both internal and external walls) + parasitic area + opening of elevators

## EVM Terms and Equations

| EVM Term | | Definition | Formula |
|---|---|---|---|
| **Planned Value*** | **PV** | The budgeted cost for the work scheduled. | |
| **Earned Value*** | **EV** | The budgeted cost for the work actually completed. | |
| **Actual Cost*** | **AC** | The actual cost of the work actually completed. | |
| **Schedule Variance** | **SV** | The measure of schedule performance on a project. | **SV = EV – PV** |
| **Cost Variance** | **CV** | The measure of cost performance on a project. | **CV = EV – AC** |
| **Schedule Performance Index** | **SPI** | The measure of progress achieved compared to progress planned. | **SPI = EV / PV** |
| **Cost Performance Index** | **CPI** | The measure of the value of work completed compared to the actual cost or progress. | **CPI = EV / AC** |

**END OF PAPER**