RC7 – Cost Estimation
and Site Management

**T125**

Friday, 23/7/2021
08:30 – 11:30 AM

## TVET NATIONAL EXAMINATION, RTQF LEVEL 5, 2020-2021

**OPTION/TRADE: ROAD CONSTRUCTION**

**SUBJECT: Cost Estimation and Site Management**

**DURATION: 3 hours**

### INSTRUCTIONS TO CANDIDATES: PART II

The paper is composed of two (2) Sections as follows:

**Section I: Attempt all the Twelve (12) questions**      **(60 marks)**

**Section II: Attempt any Four (4) questions out of Six (6)**      **(40 marks)**

# MARKING GUIDE

**Section I: Attempt all the Twelve (12) questions**      **(60 marks)**

**(01)**     Differentiate minutes of meeting and photographs **(5marks)**

**Answers**

Minutes of meeting: Minutes that **capture** the purpose of the meeting and its agreed outcomes are a **record** that can be referred back to and can be used for follow-up purposes. Effective meeting minutes are clear and to the point, but at the same time, they do not leave out important information.

☐ Photographs: the essential purpose of photography is communication. Few people take picture solely to please them.

**(02)**     Mention four (4) forms of elaboration for particular cases at building site. **(5marks)** **Answer**

**Elaboration of forms for particular cases:**

Incident /Challenge form

Claim form

Weather

Emergency form

**(03)**     Outline down five (5) data collection about work done at building site. **(5marks)**

**Answer**

Collect Data about Work Done

**Information about activities:**

Quantities of works done

Procedures of work done

Methods of site data collection

Site Investigation

Field Measurement

Site Observation

**(04)**     Highlight at least five (5) contents of site report. **(5marks)**

**ANSWER**

**Content of site report**

Work progress

Workforce

Stock situation

Supply status

Weather conditions

Materials usage

Work quality

Financial situation

**(05)** Mention five (5) methods of document site arrangement. **(5marks)**

**Answer**

•Methods of document arrangement:

Chronological method: arrangement based on time

Subject method: arrangement according to the name of subjects

Alphabetical filling: based on alphabets

Numerical filling: arranged according to the numerical

Geographical filling: according to town, districts, regions, countries, zones...

**(06)** Define the following terms :( **5marks)**

a. Activity: is action or task to be performed
b. Scheduling: is the process of preparing work or project to be performed according to the time.
c. Bill of quantity: is a document which contains the quantity of materials and their cost required for completing the work or project.
d. Event: is something that happens, it is unusual.
    Planning: is the process of preparing the work or project to be performed.
    REFERNCE: L.U.1.IDENTIFY ACTIVITIES

**(07)** After defining work breakdown structure, differentiate two methods of work breakdown structure. **(5marks)**

Answer:

a. A work breakdown structure (WBS) is a key project deliverable that organizes the team's work into manageable sections.

Two methods of WBS:

Top dawn method: In this approach, the WBS is derived by decomposing the overall project into sub-projects or lower-level tasks. This decomposition is based on general project characteristics and not on detailed design elements; it is based on section of work.

Bottom up method: in this approach, the WBS is decomposed based on detailed design elements of work.

**(08)** Differentiate lead and lag time. **(5marks)**

Answer:

Lead time: is when the first activity is still running and the second activity starts. The balance of time for the first activity is known as Lead Time. Lead Time is the overlap between the first and second activity.

Lag Time: When the first activity completes, if there is then a delay or wait period before the second activity starts, this is called lag, and the delay is known as the Lag Time. Lag Time is the delay between the first and second activity

**(09)** List down any five (5) elements of bill of quantity **(5marks)**

Answer:

Elements of bill of quantity are:

➢ Items
➢ Quantities
➢ Unit of measurement
➢ Unit price
➢ Total amount

**(10)** Calculate the carpet area if the floor area of the building is 500sq.m and circulation area is 200sq.m. **(5 marks)**

Marking scheme:

**Given: -Floor area= 500sq.m**

- **Circulation area = 200sq.m**

**Calculation: The carpet area = Floor area minus Circulation area**

**The carpet area = 500sq.m - 200sq.m = 300sq.m**

(11)     There are the commonly units used for civil engineering works. Name at least five (5) SI basic units with their basic quantities and the corresponding symbols.                    **(5marks)**

Marking scheme:

| Nº | Unit | Quantity | Symbol |
|---|---|---|---|
| 1 | metre | length | m |
| 2 | Square metre | area | Sq.m/m² |
| 3 | Cubic metre | volume | Cu.m/m³ |
| 4 | Kilogram | mass | kg |
| 5 | litre | capacity | l |

(12)     A wall in brick is 4m of length, 3m of height and 30cm thick. Find the quantity of bricks for 600bricks/ m³ and their cost if the ratio is 40RWF/brick **(10marks)**

Marking scheme:

**Given: -Length of wall = 4m**

- **Height of wall = 3m**
- **Thickness of wall = 30cm = 0.30m**
- **Number of bricks per m³ of brickwork = 600bricks**
- **Price of one bricks = 40Rwf**

**Asked: - Number of bricks**

- **Cost of bricks**

**Calculation**

**Quantity of brickwork = Length of wall x Thickness of wall**

$$= 4m \times 3m \times 0.30m = 3.6m^3$$

- **Number of bricks = Quantity of brickwork x Number of bricks per m³ of brickwork = 3.6m³ x 600bricks/m³**

$$= 2160bricks$$

- **The Cost of bricks = 2160bricks x 40Rwf/bricks**
  $$= 86400Rwf$$

**Section II: Attempt any Four (4) questions out of Six (6)**        **(40 marks)**

**(13)** (a)Highlight any four(4) benefits of maintaining good site records. **(4marks)**

**Answer**

The benefits of maintaining good site records include:

- reducing the risk of future claims as a result of not being able to prove work was done and the standard it was done to and to show that the documentation provided was followed (or, if documentation or details were amended, that the amendment was properly authorized)

- providing an accurate and comprehensive record of all communications between parties to the contract, subcontractors, suppliers, designers, the owner and the <u>BCA</u>

- showing compliance with regulatory requirements such as the booking and carrying out of BCA inspections

- recording and measuring contract variations – not carrying out work as a result of a verbal instruction

Proving that work has been done to specification

(b)Enumerate any six (6)steps of filling a meeting minutes. **(6marks)**

**Answer**

STEPS OF FILLING A MINUTES MEETING

To write effective meeting minutes you should include:

1. The names of the participants
2. Agenda items
3. Calendar or due date
4. Action or tasks
5. The main points
6. Decision made by the participants
7. Record what is most important point
8. Future decision

**(14)** a) Draw the following network **(5marks)**

Activity H follows G

Activities J and K both follow H

Activity O follows K only

Activities L and P both follow J
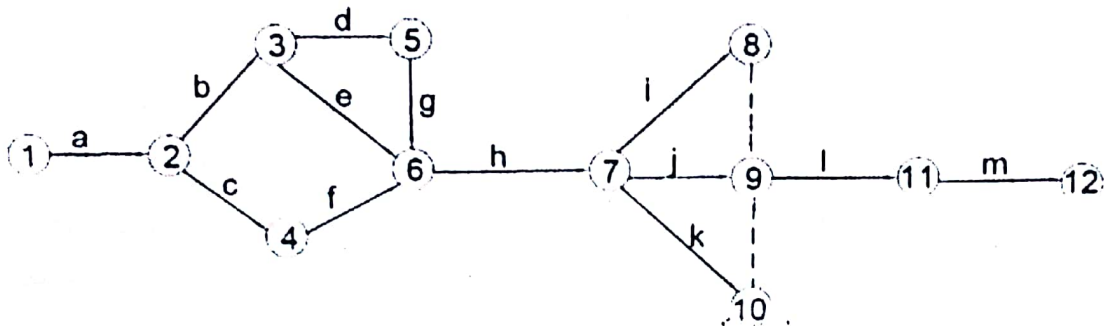
Activity M follows L

Activity Q follows both P and O

Activity N follows M

Activity R follows Q

Activity S follows both R and N

Answer:

a.



b) Briefly explain the rules of network drawing (**5marks**)

1. Starting event and ending event of an activity are called tail event and head event respectively 2. The network should have a unique starting node (tail event)

3. The network should have a unique completion node (head event)

4. No activity should be represented by more than one arrow in the network

5. No two activities should have the same starting node and the same ending node

6. Dummy activity is an imaginary activity indicating precedence relationship only. The duration of dummy activity is zero

**(15)** What is the duration in days to install 6000 square feet of walls shuttering if:

a. Crew of 2 carpenters is used with output of 200 square feet/day

Marking scheme:

a. **Duration = 6000 / 200 = 3 days**

(b)State five (5) factors which an estimator should consider in pricing of construction materials.

**ANSWER: Reference (LU 3) (2009). Process Planning and Cost Estimation. New Age International.**

   a) Construction material costs
   b) Labor wage rates
   c) Transport of materials
   d) Construction site conditions
   e) Site location
   f) Taxes
   g) Interest of contractor

(c) The price of door is 45,000 Rwf excluding VAT. If VAT is charged at 15%, find the price of the door inclusive VAT.

**ANSWER: Reference (LU 3) (2009). Process Planning and Cost Estimation. New Age International.**

   ✓ VAT = 15% of 45,000 Rwf = 6750Rwf
   ✓ Total price of door: 45,000Rwf + 6,750Rwf= 51,750Rwf

**(17)** Mr Heza wants to construct the fencing wall. Length is 15m, height is 2.4m and the thickness of wall is 0.2m. The size of brick is (20 cm * 9.5 cm *7 cm). The joint is 1 cm **(10 marks)**

By using volume method, calculate

   a) Number of brick required

   b) Quantity of mortar required

   c) Rate of bricks when the cost of one brick is 30frw

   **ANSWER: Reference (LU 2) (2009). Process Planning and Cost Estimation. New Age International.**

   ✓ Volume of wall= $15 \times 2.4 \times 0.2 m^3$=**7.2 m³** / 1pt
   ✓ Volume of one brick without mortar= $0.2 \times 0.095 \times 0.07$=**0.00133 m³** / 1
   ✓ Volume of one brick with mortar= $0.205 \times 0.1 \times 0.075$=**0.0015375m³** / 1
   ✓ Quantity of mortar for one brick=(0.0015375 - 0.00133) m³ = **0.0002075 m³**

b. Productivity is measured as 0.008 man-hour/square feet. Number of carpenters=3, and number of working hours/day = 8 hours

Marking scheme:

**b. Total man-hours needed = 6000 x 0.008 = 48 man-hours (if one man used) Duration = 48 / 8 = 6 days (if one man used)**

**Duration using 3 men = 6 / 3 = 2 days**

**(c)** Indicate the standard unit of measurement of each of the following as used in quantity surying ( cost and estimation )

   i)   Roof covering
   ii)  Reinforcement bars
   iii) BRC  Mesh Reinforcement
   iv)  Concrete to foundation
   v)   Windows

**(5marks)**

Marking scheme:

   **i) Roof covering    : measured in square metres ($M^2$)**
   **ii) Reinforcement bars : measured in Kilogram (KG)**
   **iii) BRC  Mesh Reinforcement : measured in square metres ($M^2$)**
   **iv) Concrete to foundation: measured in cubic metres ($M^3$)**
   **v) Windows : measured in Numbers/Numerated (No.)**

**(16)**    (a)Calculate the quantities of mortar for plastering a circular column with 30 cm of diameter. The height is 4m.

**ANSWER: Reference (LU 2)  (2009). Process Planning and Cost Estimation. New Age International.**

**Given:**

   ✓  Diameter (D) = 30cm = 0.3m

   ✓  Height (H) = 4m

   ✓   Circumference (C) = D x 3.14 = 0.3x3.14= 0.942m

   ✓  Area (A) = C x H = 0.942m x 4m = 3.768m²

   ✓  **Quantity of mortar= 3.768m²**

(b)State five (5) factors which an estimator should consider in pricing of construction materials.

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✓ Volume of one brick with mortar= $0.205 \times 0.1 \times 0.075 =$ **0.0015375m³** / 1

✓ Quantity of mortar for one brick=$(0.0015375 - 0.00133)$ m³ = **0.0002075 m³**

a) Number of brick= $\dfrac{\text{Volume of wall}}{\text{Volume of 1 brick with mortar}}$

Number of brick= $\dfrac{7.2 \text{ m}^3}{0.0015375\text{m}^3/\text{brick}}$ = **4,683bricks**

**b)** Volume of mortar= Volume of mortar for 1 brick x Number of brick
Volume of mortar= **0.0002075 m³ /brick x 4,683bricks= 0.971m³ / 2pts**

C ) Cost of bricks= 4,683bricks x 30Rwf/brick= **140,490Rwf /2pts**

**(18)**  (a)Outline any five (3) elements which are included on a complete drawing /

**ANSWER: Reference (LU1) Sweeting, J. (1997). Project Cost Estimating: Principles and Practice.**

- ✓ Floor plan , Elevation plan ; Roof plan ; Foundation plan;
- ✓ Perspective ; Sections

(b)What do you understand by "Bills of quantity"? **/1pt**

**ANSWER: Reference (LU1) (2009). Process Planning and Cost Estimation. New Age International.**

➢ Bills of quantities are a document comprising a list of the materials required for the works and their estimated quantities, produced by the quantity surveyor.

(c)State any five (2) elements of bills of quantities **/5pts**

**ANSWER: Reference (LU2) Publishing, B. (2013). Good Small Business Guide 2013, 7th Edition: How to start and grow your own business. A&C Black**

- ✓ Items Number; Description of items
- ✓ Quantities; Units of measurement ; Unit price; Amount

(d)Outline at least five (2) uses of bills of quantities **/5pts**

**ANSWER: Reference (LU2) Sweeting, J. (1997). Project Cost Estimating: Principles and Practice.**

- ✓ It is used to **know the cost of the whole project**
- ✓ It is used to **know the cost of each item in a project**
- ✓ It is used to **list the items needed in a particular project**
- ✓ It used in tendering analysis
- ✓ Bill of quantities helps to prepare final account