

**PWO – Surveying and Cost  
Estimation**

**T022**

**Wednesday, 16/11/2016**

**08:30 – 11:30**

**WORKFORCE DEVELOPMENT AUTHORITY**



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**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016,  
TECHNICAL AND PROFESSIONAL STUDIES**

**EXAM TITLE: Surveying and Cost Estimation**

**OPTION: Public Works (PWO)**

**DURATION: 3hours**

**INSTRUCTIONS:**

The paper is composed of **three (3) main Sections** as follows:

**Section I: Fourteen (14) compulsory questions. 55 marks**

**Section II: Attempt any three (3) out of five questions. 30 marks**

**Section III: Attempt any one (1) out of three questions. 15 marks**

**Allowed materials:**

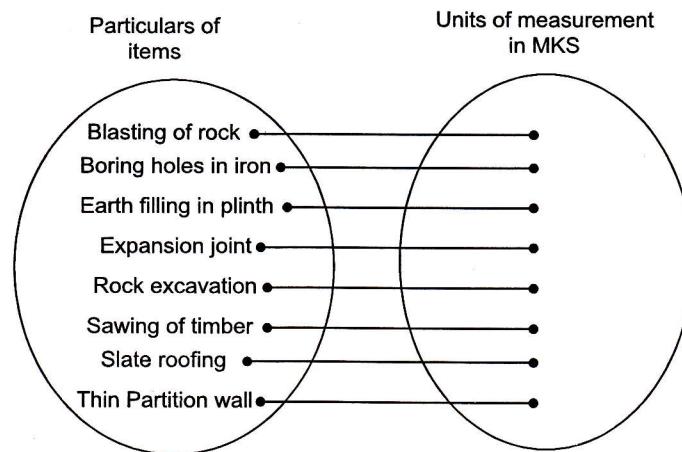
- Calculator, Ruler and square

**Note:**

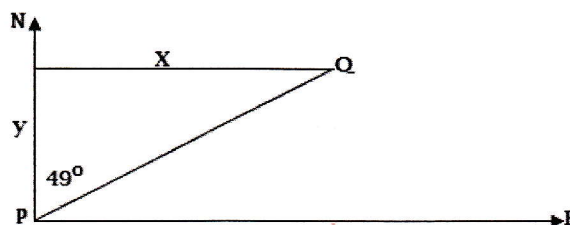
***Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.***

**Section I. Fourteen (14) Compulsory questions****55marks**

01. Differentiate between “plane surveying” and “geodetic surveying”. **2marks**
02. Mention three polar systems of angular measurement. **3marks**
03. In surveying there are three (3) sources of errors, what are they? **3marks**
04. Use definitions to differentiate between “mistakes” and “systematic error” in surveying. **2marks**
05. For what type of measurements the theodolite is used for? **2marks**
06. Distinguish between “center line method” and “crossing method” for taking out estimates. **4marks**
07. Mention and define two main processes of the bill of quantities. **4marks**
08. Assign the proper units of measurement (in MKS) to the given items. **4marks**



09. Give five (5) conditions necessary for the use of lump sum items in a building construction project. **5marks**
10. A wall in brick is 32 cm thick, 10 m long and 4.5 m height.
  - a) Calculate the volume of the wall.
  - b) Find the number of bricks for 1 m<sup>3</sup>. If the format of brick is 21 cm x 10 cm x 6 cm.
  - c) If the rate of masonry is 60.000 FRW for 1 m<sup>3</sup>, find the total cost. **6marks**
11. P and Q are two survey points, the direction from North (the bearing) of the line PQ is 49° and the horizontal length of line PQ is 45.50 m. These two quantities are the polar coordinates at point P. Calculate the value of the rectangular coordinates X and Y of point Q. **6marks**

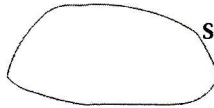


12. What are the advantages and disadvantages of invar tape? **4marks**
13. Convert the following unit measurements:
  - a) 90 inches to yards **2marks**
  - b) 2.5 km to mile **2marks**

14. A lintel of a building is rectangular shape of 20 cm x 35 cm and 16m length.
- a) If the 4Ø12 steel bars are provided in this lintel, calculate the number of steel bars to purchase for 11.50 m unit length of steel bar. **4marks**
- b) Find the total cost of lintel for 350,000 FRW/1 m<sup>3</sup> **2marks**

**Section II. Choose and answer any three (3) questions. 30marks**

15. Given a portion of land of area "S" as shown the figure below; using the trapezium rule, describe the process of calculating the area of the land.



**10marks**

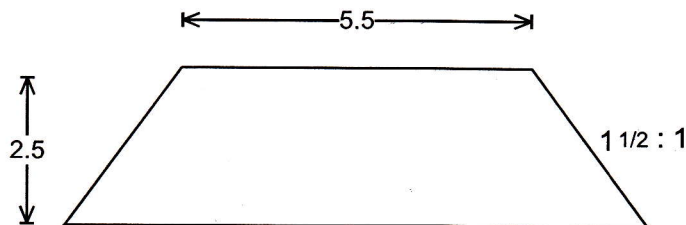
16. Briefly discuss the following branches of surveying: **10marks**
- a) Engineering surveys
- b) Cadastral surveys

17. Given below design mixes, calculate the quantity of materials. **10marks**
- a) R.C.C. (1:2:4) for 20 m<sup>3</sup> of work
- b) R.C.C. (1:3:6) for 15 m<sup>3</sup> of work

Assumptions:

- 1m<sup>3</sup> wet concrete = 1.52 m<sup>3</sup> dry concrete approximately
- Specific weight of concrete = 1440 kg/m<sup>3</sup> (or) 1.44 t/m<sup>3</sup>
- 1 bag of cement = 50 Kg

18. An earth embankment has measurements (in meters) as shown on the following figure.



If its length is 12 m, find the volume of earth work. **10marks**

19. Estimation and costing is needed for a planned construction project. Briefly summarize the necessity of cost estimation under five (5) headings. **10marks**

**Section III. Choose and answer any one (1) question. 15marks**

20. The figure below shows the plan of a proposed reservoir and dam wall. The vertical interval is 5 m, and the water level of the reservoir is to be 148 m. The enclosed areas, measured using a planimeter, are given in the table below. Calculate the volume of the water in the reservoir.

Assumptions:

- The cross section area of 150 m contour is approximately equal to the cross section area defined by the water level at 148 m.

- The small volume between the 120 m contour and the dam wall is neglected.

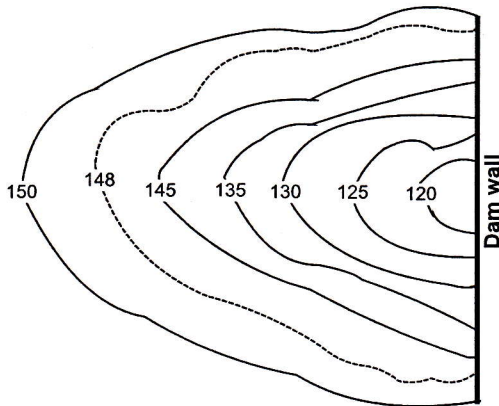


Table of areas

Contour	Enclosed area
150	15100
145	13700
140	12300
135	11200
130	9800
125	7100
120	4600

21. A group of investors intends to construct a commercial complex whose data are given below. Prepare the rough estimate of the project.

- Plinth Area = 500 m<sup>2</sup>/floor
- Height of each storey = 3.5 m
- Number of storeys = G+2
- Cubical content rate = 50,000 FRW/m<sup>3</sup>

Following rates are provided as percentages of structured cost:

- water supply and sanitary arrangement : 8%
- Electrification : 6%
- Fluctuation of rates : 5%
- Contractors profit : 10%
- Petty supervision and contingencies : 3%

22. A high quality cost-estimating process requires scheduling in clear description of steps and associated tasks.

a) Match below cost-estimating steps (1 to 12) to their corresponding descriptions (A to L).

steps	description
1	A. Check/validate and update estimate to reflect actual cost data and conduct variance analysis
2	B. Conduct sensitivity/risk Analysis
3	C. Define estimate's purpose and schedule
4	D. Draft basis of estimate document
5	E. Determine estimating approach
6	F. Develop Estimate
7	G. Develop estimating plan
8	H. Identify ground rules and assumptions
9	I. Obtain data and information
10	J. Perform peer reviews
11	K. Present estimate for approval
12	L. Store estimate data in database

b) The description "identify ground rules and assumptions" has its associated tasks. What are they?