

**PWO – Hydraulic Works**

**T022**

**Friday, 30/11/2018**

**08:30 – 11:30 AM**

WORKFORCE DEVELOPMENT AUTHORITY



P.O. BOX 2707 Kigali, Rwanda Tel: (+250) 255113365

---

**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2018,  
TECHNICAL AND PROFESSIONAL STUDIES**

**EXAM TITLE: HYDRAULIC WORKS**

**OPTION: Public Works (PWO)**

**DURATION: 3 hours**

**INSTRUCTIONS:**

The paper is composed of **the following sections:**

**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**

The use of calculator is admitted.

**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**

**55 marks**

- 
- 01.** List and explain 5 types of hydraulic structures on the basis of function. **(5 marks)**
- 02.** Mention 3 advantages of using Gabions in construction. **(3 marks)**
- 03.** List materials used to build bridges **(2 marks)**
- 04.** What is the purpose of bridges construction? **(2 marks)**
- 05.** Outline 5 types of bridges. **(5 marks)**
- 06.** Outline and explain 3 factors that influence the runoff. **(5 marks)**
- 07.** A. What is an open canal?  
B. Give types of canals based on their shapes;  
C. What is the most commonly used canal-cross section in drainage. **(6 marks)**
- 08.** Enumerate two functions of a septic tank. **(4 marks)**
- 09.** What do you understand by "Catchment area"? **(3 marks)**
- 10.** State five (5) factors you consider in selecting a site for rain gauge station. **(5 marks)**
- 11.** Differentiate the types of precipitation. **(4 marks)**
- 12.** List down materials used in constructing culverts **(3 marks)**
- 13.** Give five (5) causes of errors which occur in rainfall measurement. **(5 marks)**
- 14.** List Six (6) materials used to make bridges. **(3 marks)**

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

**30 marks**

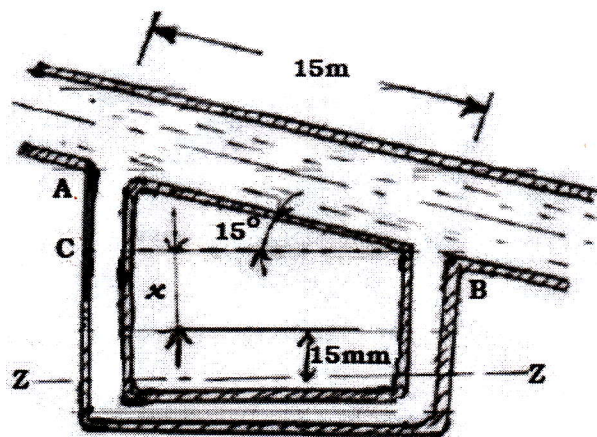
15. (a) With help of sketches, differentiate a truss bridge from cantilever bridge.  
(b) A weir of 8m long is to be built across a rectangular channel to discharge a flow of  $9\text{m}^3/\text{s}$ . If the maximum depth of water on the upstream side of the weir is to be 2m, what should be the height of the weir? Adopt  $C_d=0.62$
16. With help of sketches, differentiate the dam failure by overtopping from failure of dam due to piping through dam.
17. Name and describe five (5) areas where hydraulic structures are used.
18. State and explain four (4) applications of box culvert.
19. A manometer containing mercury is connected to two points 15m apart, on a pipeline conveying water. The pipeline is straight and slopes at an angle of  $15^\circ$  with the horizontal (figure). The manometer gives a reading of 150mm.

**(10 marks)**

**(10 marks)**

**(10 marks)**

**(10 marks)**



Determine the pressure difference between the two points of the pipeline.

Take specific gravity of mercury as 13.6 and that of water as 1.0

**(10 marks)**

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

**15 marks**

**20.** i) Describe the following :

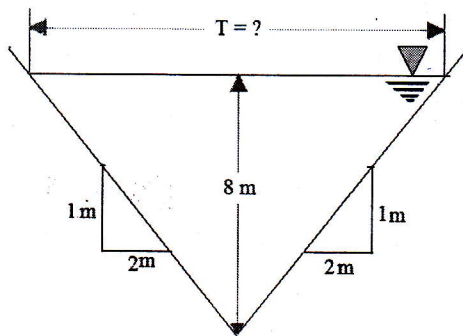
- Top width - Scour checks

ii) Differentiate all these terms Culverts, overwater bridges and dips.

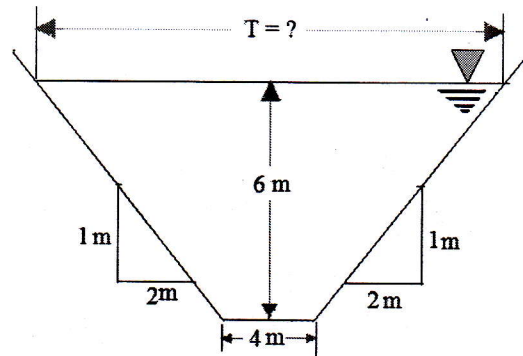
**(15 marks)**

**21.** Determine the top width (T), hydraulic radius (Rh) and the wetted perimeter (Pw) for the following figures: **(15 marks)**

i)



ii)



**22.** It is important to select the appropriate surface material for the drift, which will support the traffic as well as stand up to the expected water flow in the rainy season. Discuss the criteria to be followed while selecting surface material for the drift.

**(15 marks)**