



TECHNICAL UNIVERSITY OF MOMBASA

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## Faculty of Engineering & Technology

Department of Building & Civil Engineering

UNIVERSITY EXAMINATION FOR DIPLOMA IN:

**DIPLOMA IN CIVIL ENGINEERING (DBCE y3s2)**

**(DBCE/JAN 2014)**

ECV 2304: HYDRAULICS

**END OF SEMESTER EXAMINATION**

SERIES: MAY 2016

**TIME ALLOWED: 2 HOURS**

### **Instruction to Candidates;**

*You should have the following for this examination;*

- *Answer booklet*
- *Pocket calculator*

*This paper consists of FIVE questions. Answer ANY THREE questions.*

*Use neat, large and well labelled diagrams where required*

*Maximum marks for each part of a question are as shown*

*This paper consists of **FOUR** printed papers.*



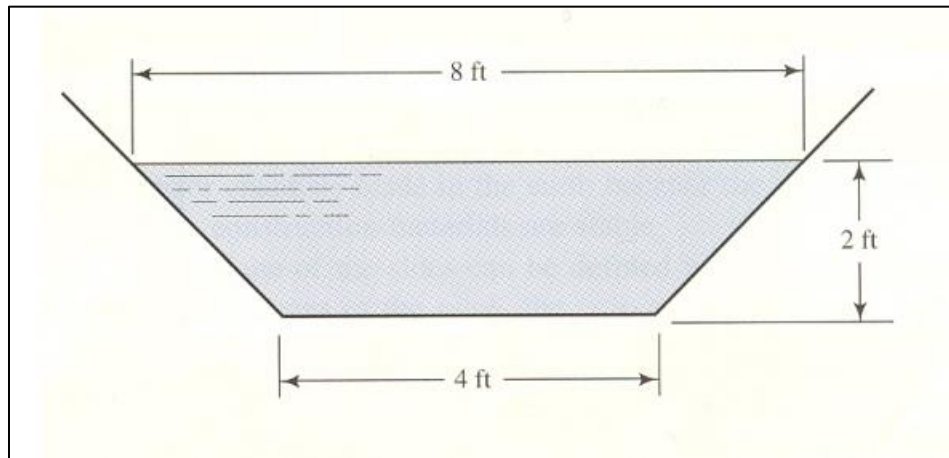
SGS ISO 9001:2008 Certified

### Question One

- a) Given a flow rate of,  $Q = 15^{-6} \text{ m}^3/\text{s}$  of olive oil (viscosity,  $10^{-4} \text{ m}^2/\text{s}$ ) in a pipe of diameter 5mm. determine;
- (i) Reynolds number
  - (ii) Expected type of flow. (7 marks)
- b) Define the following terms;
- (i) Wetted perimeter
  - (ii) Hydraulic radius (4 marks)
- c) Determine normal discharge for a 200 mm inside diameter common clay drainage tile running half-full if the slope drops 1 m over 1000 m. (7 marks)
- d) Define a turbine. (2 marks)

### Question Two

- a) Determine the best hydraulic best section for a rectangular channel. (7 marks)
- b) Determine the slope of unfinished concrete channel below (Fig; 1) if  $Q = 27.35 \text{ m}^3/\text{sec}$ .



**Fig; 1**

- c) Briefly explain working principle of a reciprocating pump. (7 marks)  
(6 marks)



### Question Three

- a) Briefly describe the difference between a turbulent and a laminar flow. (4 marks)
- b) Water is flowing 0.95m deep in a 1.8m wide open channel of rectangular cross-section. Determine the type of flow experienced in the channel. (7 marks)
- c) An individual turns on the cold water tap in the kitchen. Water flows to the tap through a copper pipe 6.00 mm diameter at a velocity of 1.00m/s. The density of the water in the pipe is  $1000\text{kg/m}^3$  and its viscosity is 0.00133 Pa.s. Determine;
- (i) Reynold's number
  - (ii) Type of flow
- (6 marks)
- d) Briefly describe the working principle of a centrifugal pump. (4 marks)

### Question Four

- a) Determine the most efficient hydraulic dimensions for a trapezoidal section. (10 marks)
- b) Design a rectangular unfinished concrete channel of,  $Q = 5.95\text{m}^3/\text{s}$ ,  $S=1.2\%$  and Normal depth =  $\frac{1}{2}$  of the width of the channel (7 marks)
- c) Briefly explain the difference between a varied steady flow and gradually varying flow. (3 marks)

### Question Five

- a) Briefly state THREE differences between a positive-displacement and kinetic pumps. (5 marks)
- b) Given;
- A triangular channel with side slopes having ratio of 1:1.5,  $Q=0.29\text{m}^3/\text{s}$ , channel is clean of excavated earth. Determine;
- (i) Depth
  - (ii) Velocity of flow
  - (iii) Froude number. (8 marks)
- c) Define the following terms;
- (i) Steady flow
  - (ii) Uniform flow
  - (iii) Uniform steady flow. (7 marks)



## APPENDIX

Channel Description	<i>n</i>
Glass, copper, plastic, or other smooth surfaces	0.010
Smooth, unpainted steel, planed wood	0.012
Painted steel or coated cast iron	0.013
Smooth asphalt, common clay drainage tile, trowel-finished concrete, glazed brick	0.013
Uncoated cast iron, black wrought iron pipe, vitrified clay sewer tile	0.014
Brick in cement mortar, float-finished concrete, concrete pipe	0.015
Formed, unfinished concrete, spiral steel pipe	0.017
Smooth earth	0.018
Clean excavated earth	0.022
Corrugated metal storm drain	0.024
Natural channel with stones and weeds	0.030
Natural channel with light brush	0.050
Natural channel with tall grasses and reeds	0.060
Natural channel with heavy brush	0.100

