



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**DIPLOMA IN CIVIL ENGINEERING WITH COMPUTER AIDED DESIGN  
DIPLOMA IN BUILDING & CIVIL ENGINEERING**

EBC 2308: FLUID MECHANICS II

END OF SEMESTER EXAMINATION

SERIES: AUGUST/SEPTEMBER 2011

**TIME: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*

This paper consists of **FIVE** questions in **TWO** sections: **A** and **B**

Answer question **ONE** is compulsory from Section A and any other **TWO** questions from section B

Maximum marks for each question are as shown

This paper consists of **THREE** printed pages

## SECTION A – COMPULSORY

### Question 1

- a) For a fixed Manning's  $n$  and slope  $s$ , find the diameter of a semi circular channel that will have the same discharge  $Q$  as a rectangular channel with  $b = 4\text{m}$  and  $y = 2\text{m}$ . (6 marks)
- b) Calculate the optimal dimension of a wooden ( $n = 0.012$ ) rectangular channel that will carry  $4.0\text{m}^3/\text{s}$  at  $s = 0.0008$ . (6 marks)
- c) A triangular duct flows partly full as shown below, if the critical depth is  $0.06\text{m}$  and  $n = 0.016$ , Compute;
- (i) The critical flow rate (12 marks)
- (ii) The critical slope (6 marks)

1m

## SECTION B (Answer any TWO questions)

### Question 2

- a) For a rectangular channel with a flow of  $20\text{m}^3/\text{s}$  at a velocity of  $5\text{ m/s}$ . What should width  $b$  and depth  $y$  be for the best hydraulic section (8 marks)
- b) What is the critical depth for a right triangular cross-section for a flow of  $4\text{m}^3/\text{s}$ ? (12 marks)

### Question 3

- a) How much head loss will be produced by sending  $0.5\text{m}^3/\text{minutes}$  of water a distance of  $2000\text{m}$  using commercial steel pipes of diameter  $50\text{mm}$ ? (10 marks)
- b) What would be the head loss if the diameter is  $100\text{mm}$ ? (3 marks)  
The water temperature is assumed to be  $20^\circ\text{C}$ .

Assume  $\lambda = 0.026$

- c) The discharge over a rectangular notch is to be  $0.14\text{m}^3/\text{s}$ . When the water level is 23cm above the sill. If the coefficient of discharge is 0.6, calculate the width of the notch required (7 marks)

#### Question 4

- a) Water from a large reservoir is discharged to the atmosphere through a 100mm diameter pipe 450m long. The entry from the reservoir to the pipe is sharp and the outlet is 12m below the surface level in the reservoir.

Taking  $f = 0.001$  in the Darcy formula, calculate the discharge (10 marks)

- b) A reservoir discharges through a sluice gate 0.9m wide by 1.2m deep. The top of the opening is 0.6m below the water level in the reservoir and the downstream water level is below the bottom of the opening. Calculate the theoretical discharge through the opening (10 marks)

#### Question 5

- a) A sharp-edged orifice of 50mm diameter discharges water under a head of 4.5m. Find the coefficient of discharge if the measured rate of flow is  $11.45\text{dm}^3/\text{s}$  (6 marks)
- b) If there is an average pressure within the jet in the plane of the orifice of  $26.5\text{KN}/\text{m}^2$  above atmospheric pressure, calculate the coefficient of contraction. Neglect loss of energy due to friction (14 marks)