THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

University Examination 2010

THIRD YEAR/FIRST SEMESTER EXAMINATION
FOR THE DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING
SUPPLEMENTARY PAPER

ECE 2304: HYDRAULICS I

SERIES: APRIL/MAY 2010 **TIME:** 2 HOURS

Instructions:

Answer Question **One** and any other **TWO** questions.

QUESTION ONE

(a) The water supply to a gas water heater contracts from 10mm in diameter at A (fig.) to 7mm in diameter at B.

If the pipe is horizontal, calculate the difference in pressure between A and B when the velocity of the water at A is 4.5m/s. (20 marks)

(b) This pressure difference operates the gas control through connections which are taken to a horizontal cylinder in which a piston of 20mm diameter moves.

Ignoring friction and the area of the piston connecting rod, calculate the force on the piston. (10 marks)

QUESTION TWO

(a) A trapezoidal notch has a base of width L and each side makes an angle θ to the vertical. Deduce an expression for the discharge through the notch. (10 marks)

(b) A 90° V-notch has a coefficient of discharge of 0.6.
Calculate the discharge when the observed head is 0.65m above the bottom of the notch. (10 marks)

QUESTION THREE

Calculate the value of the angle θ for a V-notch which is to discharge 0.41m3/s under a head of 0.6m, assuming a coefficient of discharge of 0.6. (20 marks)

QUESTION FOUR

The Kuttei's formula for C based on the analysis of the behavior of rivers is

$$C = \frac{23 + \frac{0.00155}{2} + \frac{1}{n}}{1 + \left(23 + \frac{0.00155}{2}\right)\frac{n}{\sqrt{m}}}$$

When n has the same value as in Manning's formula.

Bazin's formula for C is

$$C = \frac{86.9}{1 + \frac{k}{\sqrt{m}}} \quad \text{in SI units.}$$

where k depends on the surface roughness and is given as 1.3.

For a channel which is trapezoidal in cross-section with a bottom width of 1.8m and side sloes of 1 vertical to 2 horizontal, find the velocity of flow if the depth of water is 1.5m and the slope is 0.57m per Km. (20 marks)

QUESTION FIVE

A rectangular channel with a flat bed and width 5m and maximum depth 2m has a discharge of $10m^3/s$
The normal depth is 1.25m.
Calculate the depth of flow in a section in which the bed rises 0.2m over a distance of 1m.
Assume frictional losses are negligible. (20 marks)