THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

EBC 2320: HYDRAULICS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Mathematical tables*
- *Scientific calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

Question 1 (20 marks)

a) Define the following types of flow
   (i) Steady uniform flow
   (ii) Unsteady non-uniform flow **(5 marks)**

b) A V-shaped open channel has an included angle of 90^o and conveys water at a rate of 0.05m^3/s when the depth of flow is 225mm. Assuming C = 50, determine the slope of the channel **(8 marks)**

c) A semi circular channel is to convey 1.5m^3/s of water when flowing full. If the bed slope is 1:1000 and C = 60 determine the diameter of the channel **(7 marks)**

Question 2 (20 marks)

a) A rectangular channel is to convey water at a rate of 10m3/s its bed slope being 1:500 if mannings n = 1/60, design the most economical section **(7 marks)**

b) A trapezoidal channel has side slopes of 2 vertical to 3 horizontal. If it is required to discharge water at a rate of 20m3/s with a bed slope of 1:2000, and mannings n = 0.01, design the channel **(13 marks)**

Question 3 (20 marks)

a) A channel of rectangular section is 8m wide and is discharging water at a rate of 12m3/s with an average velocity of 1.2m/s. Determine
   (i) The normal depth
   (ii) The critical depth
   (iii) The critical velocity
   (iv) Whether flow is streaming or shooting
   (v) Minimum specific energy
   (vi) Specific energy of flowing liquid **(14 marks)**

b) With the aid of a sketch, outline the method of constructing a specific energy curve (i.e. relationship of specific energy to depth of flow) for an open channel **(6 marks)**

Question 4 (20 marks)

a) Water flows in a rectangular channel at a rate of 3.75m^3/s per metre width. The depth of flow at a certain section is 1m. If a hydraulic jump occurs on the downstream section. Find the depth of flow after the hydraulic jump. **(4 marks)**

b) A horizontal rectangular channel has a sluice opening upwards as shown in figure 1 when the sluice is partially opened, water issues at 5m/s with a depth of 500mm. determine the loss of head due to the hydraulic jump **(11 marks)**

Figure 1

c) (i) Write the expression for Froude's number explaining all the terms used.
(ii) Using Froude's number, distinguish the following:
- streaming flow
- critical flow
- shooting flow **(5 marks)**

Question 5 (20 marks)

a) Define the following terms
(i) Pump
(ii) hydraulic turbine **(4 marks)**

b) Explain **TWO** functions of an air vessel when placed on the delivery side of a reciprocating pump **(4 marks)**

c) A single acting reciprocating pump has a plunger 300mm diameter with a stroke length of 200mm. The speed of the pump is 30rpm and it delivers 6.5l/s of water. Determine
(i) The coefficient of discharge of the pump
(ii) The percentage slip of the pump **(6 marks)**

d) With the aid of a sketch, briefly describe the working principle of a single acting reciprocating pump **(6 marks)**