THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUIDLING & CIVIL ENGINEERING

EBC 3108: FLUID MECHANICS II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

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

Question One (20 Marks)

a) A venturimeter with a throat 100mm diameter is connected to a 300mm diameter water pipe. A differential mercury manometer connected to the inlet and throat of the meter reads a deflection of 25cm. If the coefficient the meter cd = 0.95. Determine the discharge in: **(10 marks)**
   i) m³/s
   ii) kg/min

b) A rectangular orifice 2m wide and 4m deep is discharging water from a tank whose water level is 10m above the top edge of the orifice. Find the discharge if cd = 0.6 **(4 marks)**

c) A pitot-static tube is placed in the centre of a 250mm diameter pipe conveying water at a rate of 0.041dm³/s. The difference in pressure between the two orifices is measured as 60mm of water. If the mean velocity in the pipe is 0.8 times the central velocity, calculate the coefficient of the meter. **(6 marks)**

Question Two (20 marks)

a) The actual velocity in the contracted section of a jet of liquid flowing from a 50mm diameter orifice is 8.5m/s under the head of 4.6m. If the actual discharge is measured as 600l/minute. Determine the coefficient of:

   i) Velocity Cr
   ii) Discharge Cd
   iii) Contraction Cc **(12 marks)**

b) With the aid of sketches differentiate the following:
   i) Orifice plate from venture nozzle
   ii) A small orifice from mouthpiece. **(4 marks)**

c) State **FOUR** assumptions made in deriving 'Bernoulli's Theorem" **(4 marks)**

Question Three (20 marks)

a) A weir 2.5m long has 0.6m head of water over the crest of the weir. If the channel approaching the weir is 6m wide. Determine the discharge over the weir to 2 decimal places considering the velocity of approach using Francis formula. **(14 marks)**

b) Outline **THREE** major differences between a notch and a weir. **(6 marks)**

Question Four (20 marks)

a) Derive the discharge equation over a rectangular notch using the usual notations. **(8 marks)**

b) A trapezoidal notch has 30cm base and sides sloping at 30° to the vertical if the head causing flow is 160mm and Cd = 0.62, determine the rate of flow. **(6 marks)**

c) A 20m long Cippoletti weir discharges 200m³/s of water. The Cd = 0.6, determine the height of the weir. **(4 marks)**

d) With the aid of sketches, illustrate the following flow conditions in a weir:
   i) Free flow
   ii) Submerged flow **(2 marks)**

Question Five (20 marks)

a) A 200mm diameter pipe conveys 18m³/hr of water through a 150m long pipe. Calculate the loss due to friction using:
   i) Darcy's equation, if f = 0.01
   ii) Chezy's equation, if c = 44.31
   iii) Manning's equation, if n = 0.0137 **(9 marks)**

b) The pipeline shown in figure 1 has the following particulars dia AB=CD = 300mm, dia BC=150mm,
   Length AB=60m, BC=30m, CD=30m
   Pressure at A = 200m of water
   Pressure at D = 179m of water

   Figure 1

   Darcy's f for AB & CD = 0.005 and for BC = 0.00375. The coefficient of contraction Cc = 0.622. Determine the discharge considering all losses. **(11 marks)**