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 BUILDING & CIVIL ENGINEERING

EBC 3108: FLUID MECHANICS

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2012
TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions. Answer question 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 flow nozzle 100mm diameter is installed in a 300mm diameter water pipe. A differential mercury manometer connected to the inlet and throat of the meter reads a deflection of 250mm. If the coefficient of a deflection of 250mm. If the coefficient of the meter Cd = 0.95, determine the discharge in:
  i) L/s
  ii) Kg/min

b) A siphon has a uniform diameter of 75mm and consists of a bent pipe with its crest 1.8m above the water with its crest 1.8m above the water level, discharging into the atmosphere 3.6m below the water level. Assuming that the atmospheric pressure to be 10m of water and neglecting friction losses, determine:
  i) Velocity of flow
  ii) Discharge
  iii) Absolute pressure at the crest level   **(10 marks)**

Question Two (20 Marks)

a) The actual velocity in the contracted section of a jet of liquid flowing from a 5cm diameter orifice is 8.5m/s under a head of 4.6m. the actual discharge is measured as 10dm3/s.
  Determine:
  i) The coefficient of velocity Cv
  ii) The coefficient of discharge Cd
  iii) The coefficient of contraction Cc   **(12 marks)**

b) The head of water over a rectangular notch is 900m when the discharge is 0.3m3/s. If Cd = 0.62, determine the length of the notch.   **(4 marks)**

c) With the aid of sketches, differentiate the following:

  i) Orifice plate from a flow nozzle
  ii) A mouthpiece from a small orifice   **(4 marks)**

Question Three (20 Marks)

a) Define the following terms:
  i) Steady flow
  ii) Uniform flow
  iii) Laminar flow   **(6 marks)**

b) A rectangular tank 12m long and 8m wide contains water to a depth of 4m. The tank is fitted with an orifice at the bottom whose diameter is 360mm and has a Cd = 0.6. Determine:
  i) The time required to completely empty the tank
  ii) The time required to drop the water level by 1m from initial level
  iii) The depth to which water falls in 4 minutes
  iv) The quantity of water discharged in 4 minutes

Question Four (20 marks)

a) A sluice gate is opened such that the opening is 1.2m wide and 0.6m deep. The upstream water level is 1.0m above the top edge of the opening and the downstream water level is 0.3m below the top edge of the opening. Assuming Cd = 0.62, determine the discharge through the opening. **(6 marks)**

b) Trapezoidal notch has a base 0.3m long and sides inclined at 30° to the vertical. The head causing flow is 0.16m. Cd = 0.62. Calculate the discharge of water over the notch in kg/s. **(10 marks)**

c) Outline **TWO** major differences between 'notch' and a 'weir' **(4 marks)**

Question Five (20 marks)

a)

Figure 1

b) Water discharges from a large tank through two pipes in series as shown in figure. Determine:
 (i) All the individual energy losses
 (ii) The discharge through the pipe **(14 marks)**

c) A 200mm diameter horizontal pipeline AB is 600m long. The readings of pressure gauges fitted at A and B are 1521 N/m^2 and 931 N/m^2 respectively. If Darcy's f = 0.01. Determine the discharge through the channel. **(6 marks)**