THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

((A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 2308: FLUID MECHANICS II

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

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*

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 horizontal venturimeter 160m x 80mm is used to measure the flow of an oil of sp gr 0.8. If the flow is 50l/s and Cd = 1, determine the deflection of the oil-mercury gauge. **(8 marks)**

b) (i) Sketch an orifice nozzle.
(ii) An orifice meter with 100mm dia orifice fitted in a 250mm dia pipe has a Cd = 0.65. The Pipe delivers oil with a density of 800kg/m^3. A differential mercury manometer connected to both sides of the orifice measures a deflection of 80mm of mercury. Determine the rate of flow. **(10 marks)**

c) State TWO assumptions made in deriving Bernoulli's equation. **(2 marks)**

Question Two (20 marks)

a) A Siphon has a uniform diameter of 75mm and consists of a bent pipe with its crest 1.2m above the water level discharging into the atmosphere 4.0m below the water level. Assuming that the atmospheric pressure is equivalent to 10m of water and neglecting friction losses, determine:
i) Velocity of flow
ii) Discharge
iii) Absolute pressure at crest level **(10 marks)**

b) A swimming pool 10m long and 5m wide contains water to a depth of 6m. The pool is fitted at the bottom with an orifice 360mm diameter and a coefficient of discharge of 0.6. Calculate:
i) The time required to empty the pool completely through the orifice
ii) The time required to make the water level fall up to 2m from bottom.
iii) The depth to which water falls in 6 minutes
iv) The quantity discharged in 6 minutes. **(10 marks)**

Question Three (20 marks)

a) A 60mm diameter orifice is discharging water under a head of 9m. Assuming Cd = 0.625 and Cv = 0.98, determine:
i) The actual discharge
ii) The actual velocity of the jet at the vena contracta
iii) Diameter of jet at vena contracta **(8 marks)**

b) The following data was collected during a laboratory exercise to calibrate a small orifice.
- Diameter of orifice 20mm
- Diameter of jet at vena contracta 19.8mm
- Horizontal and vertical coordinates of a point on the jet from the vena contracta 290mm and 35mm respectively
- Head causing flow 1.45mm
- Actual discharge was measured as 100 litres in 94 seconds.

Determine:

i) The coefficient of contraction (Cc)

ii) The coefficient of velocity (Cv)
iii) Using the direct and indirect method the coefficient of discharge (Cd) **(10 marks)**

c) Differentiate between a small orifice and a mouth piece. **(2 marks)**

Question Four (20 marks)

a) (i) Derive the expression for actual discharge over a v-notch using usual notation

(ii) During an experiment in a laboratory 280 litres of water flowing over a right angled v-notch was collected in 1 minute. The head causing flow was 100mm.

Determine the coefficient of discharge of the notch. **(12 marks)**

b) In a laboratory experiment, a cippoletti weir with a crest length of 400mm is used to measure the flow of water in a rectangular channel 600mm wide. The water level in the channel is 50mm above the crest of the weir. If the coefficient of discharge of the weir is 0.63, estimate the discharge in the channel in m^3/s (to two decimal places) considering velocity of approach. **(8 marks)**

Question Five (20 marks)

a) Water is flowing through a pipe 200mm in diameter and 60m long with a mean velocity of 2.5m/s. Determine the head lost due to friction using:
i) Darcy's Formula if f = 0.005
ii) Chezy's Formula if c = 55 **(6 marks)**

b) Two reservoirs whose surface elevations differ by 10m are connected by three pipes laid in series as shown in figure 1. Calculate:

i) All the individual losses
ii) The discharge through the pipes

All changes of pipe sections are sudden and Cc = 0.735 and lengths L, diameter d and Darcy's f are as shown **(14 marks)**

10m