**FACULTY OF ENGINEERING AND TECHNOLOGY IN CONJUCTION WITH KENYA INSTITUTE OF HIGHWAYS AND BUILIDNG TECHNOLOGY (KIHBT)**

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

HIGHER DIPLOMA IN BUILDING ECONOMICS

EBE 3117: HYDRAULICS I A

END OF SEMESTER EXAMINATIONS
SERIES: OCTOBER 2016

**TIME: 2HOURS**

**Instruction to candidates**
You should have the following for this examination
  - Answer booklet
  - Pocket Calculator

This paper consist of five question.
Answer any three questions of the five questions
All question carry equal marks
Maximum marks for each part of a question are as shown
This paper consist of two printed pages

## QUESTION 1

a) A certain liquid has a mass of 1200 kg and a volume of 1.5 m$^{3.}$. Determine the following in SI units

   i.   Its unit weight
   ii.  Its mass density
   iii. Its specific gravity
   iv.  The volume of 1600 N of the liquid

                    (Make any necessary assumption)

                                                        (9  marks)

b) State FOUR assumptions made deriving the Bernoulli's theorem

                                                        (4  marks)

c) Define the following terms

   i.   Dimension
   ii.  Unit of measurement
   iii. Pressure
   iv.  Viscosity
   v.   Ideal fluid
   vi.  mass

                                                        (7 marks)

## QUESTION 2

a) Water flows through pipe AB, 1.2m in diameter at 3m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches into CD and CE. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Determine;

   i.   The discharge in AB
   ii.  The velocity in BC
   iii. The velocity in CD
   iv.  The diameter of CE


                                                        (7marks)

b) A 25 cm diameter pipe carries oil of specific gravity 0.9 at a velocity of 3 m/s. at another section the diameter is 20 cm. determine
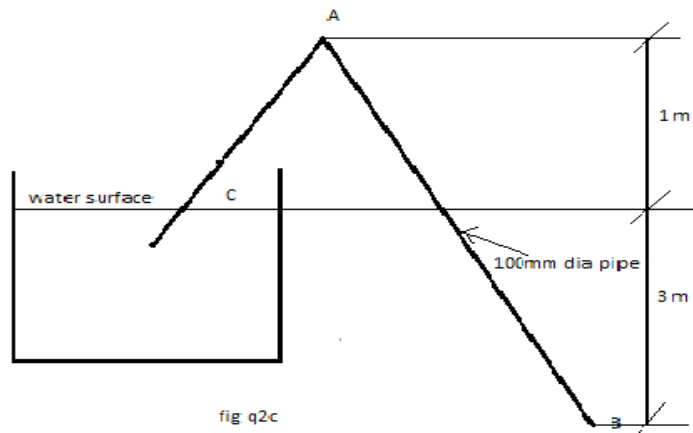
   i.   The velocity at the 20 cm diameter section
   ii.  The mass flow rate of the oil

                                                        (5 marks)

c). For the syphon shown in fig q2c, determine;

   i.   The flow rate through the syphon
   ii.  The pressure at A                               (8 marks)

fig q2c

# QUESTION 3

a) .A 2000 m long pipe discharges water at a rate of 200l/s. The head lost due to friction is 4 m. if chezy's C=50 in SI units, determine the diameter of the pipe.          (6marks)

b) A 200 mm diameter pipe AB is 500 m long. The difference of pressure between the two ends of the pipe is 4 m of water. If Darcy's f=0.009, determine the discharge through the pipe

(4 marks)

c) Water is discharged from a reservoir into the atmosphere through a pipe 39 m long. There is a sharp entrance into the pipe and the diameter is 50 mm for the first 15 m from the entrance. The pipe then suddenly enlarges to 75 mm for the remainder of its length. Darcy's f=0.0048 for the 50 mm dia pipe and 0.0058 f0r the 75mm dia pipe. The discharge in the pipe is 2.8l/s. Determine the difference in levels between the reservoir and the pipe outlet.    (10marks

# QUESTION 4

a) 16.5 m$^3$/s is flowing through a trapezoidal channel with a water depth of 1.2 m. The channel has a base width of 9 m and side slopes of 2:1(V: H). if chezy's c=49.5, determine the bed slope of the channel.                                     (6marks)

b) For a circular pipe 1.8 m diameter, determine the depth for ;

|      |                    |            |
| ---- | ------------------ | ---------- |
| i.   | maximum discharge  |            |
| ii.  | maximum velocity   | (9 marks)  |

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c) Derive the expression for the best rectangular open channel proportions, using the usual notations.

(5 marks)

**QUESTION 5**

a).State THREE advantages of a V-notch over a rectangular weir. (3 marks)

b).A $60^0$ V-notch has a coefficient of discharge cd of 0.6. If the head causing flow is 0.3m, determine the discharge over the notch. (3 marks)

c).A cipolletti weir has a crest length of 2.0 m and a cd of 0.62. If the head causing flow is 1 m, determine the discharge. (3 marks)

d).A 36 m long weir is divided into 12 equal bays by vertical columns, each 0.6 m wide. Assuming that the velocity of approach is 2 m/s and the head causing flow is 1.2 m, determine the discharge over the weir considering both velocity of approach and end contractions. Use Francis formula (where cd=0.623). (9 marks)

c).Differentiate between a "suppressed weir" and a "drowned weir" (2 marks)