TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology in Conjunction with Kenya Institute of Highways Building & Technology (KIHBT)

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBE 3117: HYDRAULICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (Compulsory)** any other **TWO** questions
Maximum marks for each part of a question are as shown
Use neat, large and well labeled diagrams where required
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Define the following terms using mathematical symbols/expressions where appropriate:
   (i) Mass density
   (ii) Unit weight
   (iii) Relative density
   (iv) Weight **(8 marks)**

b) State the SI units for the quantities defined in 1(a) **(4 marks)**

c) A circular pipe 250mm diameter carries an oil of specific gravity 0.8 at a rate of 120l/s and under a pressure of 20Kpa. Calculate the total energy in m of oil at a point 3m above datum **(6 marks)**

d) State TWO assumptions made in deriving Bernoulli's theorem **(2 marks)**

Question Two

a) (i) Write the equation for calculating Reynolds number and define all the terms:

(ii) Explain how turbulent and laminar flow can be differentiated using Reynolds number **(7 marks)**

b) A pipe 5m long is inclined at an angle of 15^{o} with the horizontal. The pipe is tapering with the smaller section, 80mm in diameter at a level lower than the larger section which is 240mm in diameter. If the velocity at the 80mm diameter section is 1m/s, determine the difference in pressure between the two sections (Ignore energy losses) **(9 marks)**

c) Define the following in relation to moving liquid:
   (i) Kinetic energy
   (ii) Potential energy **(4 marks)**

Question Three

a) Water flows through a 200mm diameter pipe, which is 30m long with a velocity of 3m/s. Find the head lost due to friction using:
   (i) Darcy's formula if f = 0.01
   (ii) Chezy's formula if c = 44.31 **(9 marks)**

b) Two reservoirs are connected by a straight pipe 150m long. The first 60m of the line is 75mm diameter and the remaining length is 150mm diameter. The change in size is sudden and the pipe entry and exit are sharp (sudden). The water surface level in the upper reservoir is 15m above that of the lower reservoir. Assuming Darcys f = 0.01 for both pipes:
   (i) Tabulate all the losses
   (ii) Determine the flow rate **(11 marks)**

Question Four

a) An irrigation channel of trapezoidal section with side slopes of 3 horizontal to 2 vertical is required to convey water at a rate of $10m^3/s$. It has a bed slope of 1:600 and manning's n = 0.0133. Determine the dimensions of the best section **(11 marks)**

b) A channel has vertical walls 1.5m apart and a semi-circular insert as shown in figure 1. The depth of flow at the centre is 1.0m and the bed. Slope is 1:2000. Assuming chezy's C = 50, determine the discharge

1.0m

Question Five

a) The sides of a trapezoidal notch makes an angle of 22^o with the vertical. The crest of the notch is 20cm long and the head causing flow is 25cm. If $C_d = 0.6$, determine the discharge **(7 marks)**

b) Water is flowing over a cippoletti well which has a base length of 2.0m. The head causing flow is 64cm and $C_d = 0.62$. Determine the discharge in LPM **(4 marks)**

c) Differentiate a 'notch' from a weir' in relation to:
   (i) Material of construction
   (ii) Size
   (iii) Where it is used **(6 marks)**

d) State THREE conditions to be met while installing a rectangular notch **(3 marks)**