TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE Y3 S1)

ECE 2305: HYDRAULICS I

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

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

This paper consists of **FOUR** questions. Answer question **ONE (COMPULSORY)** and 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 **TWO** printed pages

Question One (Compulsory)

a) Define the following:
   (i) Turbulent flow
   (ii) Steady flow
   (iii) Lamina flow
   (iv) Normal depth
   (v) Critical depth **(5 marks)**

b) Calculate the normal flow depth in a trapezoidal channel with side slopes 1 in 1.5, bottom width 7.6m and channel slope 0.00088, and if the discharge is 42m^3/s and mannings coefficient is 0.02 **(10 marks)**

c) The specific energy in non-uniform flow can be varied, explain **(2 marks)**

d) A channel of 5 metres wide is discharging $20m^3/s$ of water. Determine the depth of water, when the specific energy of the flowing water is minimum **(13 marks)**

Question Two

a) State a method of dimensional analysis that involves a large number of variable that is dimensionally homogeneous. **(5 marks)**

b) Calculate the most economical cross-section of a rectangular channel to carry $0.3m^3/s$ of water when bed slope is in 1000. Assume Chezy's C = 60 **(10 marks)**

c) A cement-lined rectangular channel 6 metres wide carries water at the rate of $30m^3/s$. Find the value of manning's constant if the slope required to maintain a depth of 1.5m is 1/625 **(5 marks)**

Question Three

a) Show that for a circular culvert of diameter D the velocity of flow will be a maximum when the depth of flow h at the centre is 0.8D **(10 marks)**

b) Water at the rate of $0.4m^3/s$ flows through a 1metre ϕ vitrified sewer, when the sewer pipe is half full. Calculate the slope of the water, if mannings n = 0.013 **(10 marks)**

Question Four

a) Determine the maximum discharge over a broad-rested weir 60m long having 0.6m height of water above its crest. Take coefficient of discharge as 0.595. Also upstream side of the weir has a cross-sectional area of $45m^2$

b) The horizontal scale of a turbine model is 1/15. If the speed of the prototype is 300r.p.m under a head of 10m, calculate the speed of the model r.p.m under a head of 200mm

Question Five

a) Show that the discharge of a centrifugal pump is given by;

$$Q = ND^3 f\left[\frac{gH}{N^2D^2}, \frac{\mu}{ND^2\rho}\right]$$

Where N is the speed of the pump in r.p.m D the diameter of the impeller, g acceleration due to gravity, H manometric head μ viscosity of fluid and ρ the density of the fluid **(20 marks)**