TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2305: HYDRAULICS I

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME ALLOWED: 2 HOURS

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

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** in section **A** and any other **TWO** questions from section **B**
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

SECTION A

Question One (Compulsory)

a) Differentiate between critical depth and a hydraulic jump. **(2 marks)**

b) By differentiating the specific energy equation and equating to zero show that the critical depth y_c is given by:

$$y_c = \frac{v_c^z}{2g}$$

(6 marks)

c) A channel of 5m wide is discharging 20m^3/s of water. Calculate the depth of water, when the specific energy of the flowing water is minimum **(4 marks)**

d) A cement lined rectangular channel 6m wide carries water at the rate of 15m^3/s.

(i) Calculate the critical depth and; **(5 marks)**
(ii) Critical velocity **(5 marks)**

e) A rectangular channel 2.4m wide is provided with a venturiflume of 1.5m wide throat. Calculate the quantity of water flowing through the venturiflume, when the depth of water into upstream side is 1.2m and that the throat is 0.9m. Take coefficient of ventriflume as 1. **(8 marks)**

SECTION B (Attempt any TWO questions)

Question Two

Determine 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 manning roughness coefficient is 0.02.
(20 marks)

Question Three

a) An oil having kinematic viscosity of 21.4 stokes is flowing through a pipe of 300mm diameter. Calculate the type of flow, if the discharge through the pipe is 15 litres/s **(11 marks)**

b) Discuss the THREE types of hydraulic similarities or hydraulic similitude in model analysis.
(9 marks)

Question Four

a) A model of spillway is constructed to a scale of 1:30 in a flume. The length of the spillway is 30m. if the discharge over the spillway at the head of 6m (depth of flow over spillway) is $443.6m^3/s$. Calculate the corresponding head and discharge of the model required for this model study.
(6 marks)

b) A dam 35m long is to discharge water at the rate of $114m^3/s$ under a head of 2.7m. calculate:
(i) The length of the model and
(ii) Head of water if the supply available in the laboratory is 30 litres/s **(6 marks)**

c) A turbine model of scale 1:10 is running at 475r.p.m under a head of 20m. calculate the speed of the actual turbine **(2 marks)**

d) Machio dam in Japan was modeled with a model scale of 1/60. The prototype is an ogee spillway designed to carry a flood of $3200m^3/s$.

(i) Calculate the discharge of the model for the designed flood in m^3/s.
(ii) What time in the model is represented by one day in the prototype? **(12 marks)**

Question Five

a) A weir of 8m long is to be built across a rectangular channel to discharge a flow of $9m^3/s$. if the maximum depth of water on the upstream side of the weir is to be 2m. Calculate the height of the weir. Adopt $C_d = 0.62$. **(8 marks)**

b) A sewer diameter 0.6m has a slope s_o of 1 in 200. Calculate the:
(i) Maximum velocity of flow that can occur, and:
(ii) The discharge at this velocity Take C = 55 SI units **(7 marks)**

c) Check the dimensional homogeneity of the following common equations in the field of hydraulics:

(i) Q = $C_d.a\sqrt{2gH}$ **3 marks)**

(ii) $V = c\sqrt{mi}$ **(2marks)**