TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

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

ECE 2304: HYDRAULICS I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: JULY 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
Answer booklet
This paper consists of **FIVE** questions. Answer any **THREE** questions of the **FIVE** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **TWO** printed pages

Question One

a) Define the following terms with respect to open channel flow:
- **(i)** Specific energy
- **(ii)** Gradually varied flow
- **(iii)** Hydraulic jump
- **(iv)** Critical flow

b) For a given cross-sectional area, determine the best dimensions for a trapezoidal channel.

c) Define the term critical velocity and derive an expression for the critical velocity in any channel in terms of the discharge Q, the area of cross-section A, and the width of water surface B.

Question Two

A trapezoidal channel has a bottom width of 6.096m, side slopes of 1:1 and flows at a depth of 914mm. For manning's n = 0.015, and discharge Q = 10.19m^3/sec, calculate:

a) The normal slope of the channel
b) The critical slope and critical depth for 10.19m^3/sec
c) The critical slope for the normal depth of 914mm

Question Three

Uniform flow occurs in a long rectangular channel 4m wide at a depth of 2m. The channel is laid on a slope of 0.001. If the manning coefficient is 0.025, determine the minimum height of a low weir that can be built on the floor of this channel to produce critical depth if there is no energy loss.

Question Four

a) Explain the expression dimensional homogeneity.

b) What do you understand by geometric similarity?

c) A rectangular pier in a river is 1.22m wide by 3.66m long and the average depth of water is 2.74m. A model of the pier is built to a scale of 1:16. A velocity of flow of 0.76m/sec is maintained in the model and the force acting on the model is 4N.
   (i) What are the values of velocity in and force on the prototype?
   (ii) If a standing wave in the model is 49mm high, what height of wave should be expected at the nose of the pier?
   (iii) What is the coefficient of drag resistance?

Question Five

A corrugated steel pipe is used as a culvert that must carry a flour rate of 5.3m^3s/sec and discharge into the air. At the entrance, the maximum available water head is 3.2m above the bottom of the pipe. The culvert is 35m long and has a squared-edged entrance and a slope of 0.003. Determine the diameter of the pipe assuming:

a) Full pipe flow
b) Partially-full pipe flow