TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2304: HYDRAULICS

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2HOURS

DATE: 16May2016

<u>**Instructions to Candidates**</u>
You should have the following for this examination
-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID
This paper consists of five questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

QUESTION ONE   (30 marks)

a)   Derive Chezy's equation for steady and uniform flow in open channel.

[10 marks]

b)   Find the rate of flow and conveyance for a rectangular channel 7.5 m wide for uniform flow at a depth of 2.25 m. The channel is having bed slope as 1 in 1,000. Take Chezy's constant C= 55.

[4 marks]

c)   Water is flowing at the rate of 16.5 cubic metres per second in an earthen trapezoidal channel with bed width 9 metres, water depth 1.2 metres and side slope 1:2. Calculate the bed slope, if the value of C in the Chezy's formula is 49.5.

[8 marks]

d) A channel has two sides vertical and semi-circular bottom of 3 metres diameter. Calculate the discharge of water through the channel, when the depth of flow is 3 metres. Take C = 67 and slope of bed as 1 in 950.

[8 marks]

QUESTION TWO   (20 marks)

a) Derive an expression for conditions of most economical section of a rectangular channel.

[5 marks]

b) A rectangular channel has a cross-section of 8 square metres, bed slope 1 in 1000. Taking Chezy's C=55, find:
i.   The size and
ii.   Discharge through the most economical channel

[7 marks]

c) A trapezoidal channel has side slope 2 vertical to 3 horizontal. It is discharging water at the rate of 35 cubic metres per second with a bed slope of 1 in 2200. Design the channel for most economical section. Use Manning's formula, take n=0.01.

[8 marks]

QUESTION THREE   (20 marks)

a) Define the following types of flows in non-uniform channel and indicate then in a specific energy curve:
i.   Streaming flow
ii.   Critical flow
iii.   Shooting flow

[4 marks]

b) A trapezoidal channel having a bed slope width of 7 metres and side slope 1:1 discharging water at the rate of 9.5 cubic metres per second. Calculate the specific energy of water, if the depth of flow in the channel is 2.5 metres.

[4 marks]

c) A channel of rectangular section 10. 5 m wide is discharging water at the rate of 15.6 cubic metres per second with an average velocity of 1.6 metres per second. Determine the type of flow.

d)   A 9 m wide channel conveys 19.5 cubic metres per second of water at a depth of 1.6 m. calculate:

    i.   Specific energy of the flowing water

    ii.   Critical depth , critical velocity minimum specific energy

    iii.   Froude number and state whether flow is subcritical or supercritical

[8 marks]

QUESTION FOUR   (20 marks)

a)   What is hydraulic jump? Explain clearly how it is formed

[4 marks]

b)   What is the use of venturiflume? Distinguish between modular and non-modular venturiflumes.

[4 marks]

c)   A rectangular channel 6 metres wide discharges 1.44 cubic metres per second of water into a 6 metres wide apron, with no slope, with a mean velocity of 6metres per second.

    i.   What is the height of the jump?

    ii.   How much energy is absorbed in the jump?

[9 marks]

d)   State conditions under which uniform and non-uniform flows are produced.

[3 marks]

QUESTION FIVE   (20 marks)

a)   Explain the factors causing gradually varied and rapidly varied flows.

[4 marks]

b)   Describe the classification of weirs

[3 marks]

c)   Show that the flow over a triangular notch is given by:

$$Q = \frac{8}{15} C_d \sqrt{2g} \ tan\frac{\emptyset}{2} H^{5/2}$$

[7 marks]

d)   A rectangular notch 0.5 metre has a constant head of 400 mm. Taking coefficient of discharge as 0.62; find the discharge over the notch.

[4 marks]

e)   State four advantages of triangular notch over a rectangular notch.

[2 marks]