



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

(INSTITUTION BASED EXAMINATION)

ECE 2304 : HYDRAULICS

END OF SEMESTER EXAMINATION

SERIES: MARCH 2017

TIME: 2 HOURS

DATE: 31st Mar 2017

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY)

- a) Describe the two types of conduits used to convey water. (5 Marks)
- b) Define the following:
- i) Turbulent flow (2 Marks)
 - ii) Laminar flow (2 Marks)
 - iii) Uniform flow (2 Marks)
 - iv) Critical depth (2 Marks)
- c) A discharge of $4.5 \text{ m}^3/\text{s}$ occurs in a rectangular channel 1.83m wide with $s=0.002$ and $m=0.012$. Calculate the normal depth for uniform flow and determine the critical depth. Is the flow subcritical or super critical? (17 Marks)

Attempt any TWO questions

QUESTION TWO

- a) Define steady flow. (5 Marks)
- b) A rectangular section channel conveys $2.5 \text{ m}^3/\text{s}$ flow with a bed slope of 0.0002. Determine the best hydraulic section dimensions if:
- i) The effective surface roughness height is 3mm
 - ii) The Manning's roughness coefficient is 0.014 (15 Marks)

QUESTION THREE

- a) Define economic section or best hydraulic channel section. (3 Marks)
- b) 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 $42 \text{ m}^2/\text{s}$ and Manning's roughness coefficient is 0.02. (17 Marks)

QUESTION FOUR

- a) Describe how the specific energy in non-uniform flow can be varied. (5 Marks)
- b) A rectangular section of 6m wide carries a flow of $18 \text{ m}^3/\text{s}$ at a depth of 2m. Calculate:
- i) Specific energy E_s
 - ii) Critical depth
 - iii) Critical velocity (6 Marks)
- c) A sewer diameter $D=0.6\text{m}$ has a slope S_o of 1 in 200. What will be the maximum velocity of flow that can occur and what is the discharge at this velocity? Take $C=55$ SI units. (9 marks)

QUESTION FIVE

- a) Explain why it is reasonable for rapidly varied flow, losses due to friction or the influence of the bed slope are insignificant. (2 Marks)
- b) i) When does a hydraulic jump occur in a flow? (2 Marks)
- ii) Give the specific energy loss in a jump (1 Mark)
- c) Describe the basic equation of gradually varied flow mathematically. (2 Marks)
- d) If the capillary rise (h) depends upon the specific weight (w), surface tension (σ) of the fluid and tube radius (r), show that

$$h = r\phi\left(\frac{\sigma}{wr^2}\right)$$

(9 Marks)

- e) The velocity at a point on a spillway model of a dam is 1.3m/s for a prototype of model ratio 1:10. Calculate the velocity at the corresponding point in the prototype. (4 Marks)