



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

TCV4315 : HYDRAULICS I

END OF SEMESTER EXAMINATION

SERIES: JANUARY 2025

TIME: 2 HOURS

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

- State how to characterize an open channel and closed conduits. (3 marks)
- Define normal depth of a channel. (3 marks)
- An earthen channel with a 3m base and side slopes 1:1 carries water with depth of 1m. The bed slope is 1 in 1600. Calculate the discharge. Take the value of N in Manning's formulae as 0.04. (10 marks)

- d) A cement lined rectangular channel 6m wide carries water at the rate of $30\text{m}^3/\text{s}$. Calculate the value of Manning's constant if the slope required to maintain a depth of 1.5m is $1/625$.
(10 marks)
- e) State why it is reasonable to consider losses due to friction and the influence of the bed slope are insignificant.
(4 marks)

QUESTION TWO

- a) Describe the phenomenon of a hydraulic jump. (3 marks)
- b) i. Describe Froude Number. (1 mark)
ii. State its physical significance. (2 marks)
iii. What does its value determine? (2 marks)
- c) i. State the formulae for specific energy loss in the hydraulic jump. (4 marks)
ii. Give a summary of the hydraulic jump that will occur if the upstream flow is super critical. (4 marks)
- d) A weir of 8m long is to be built across a rectangular channel to discharge a flow of $9\text{m}^3/\text{s}$. If the maximum depth of water on the upstream side of the weir is 2m, what should be the height of the weir? Adopt $C_d = 0.62$. (4 marks)

QUESTION THREE

- a) The daily record of rainfall over a catchment area is $0.2 \text{ million } \text{m}^3$. It has been found that 80% of the rain water reaches the storage reservoir and then passed over a rectangular weir. What should be the length of the weir if the water is not to rise more than 400mm above the crest? Assume the value of coefficient of discharge for the weir is 0.61.
(10 marks)
- b) In a power station, water is available from a reservoir at the head of 75m. If the efficiency of transmission is 60%, calculate the power available when 1.25m^3 of water flows to the station in one second.
(10 marks)

QUESTION FOUR

- a) A trapezoidal channel having bed width of 6m and side slopes 1:1 is discharging water at the rate of $8\text{m}^3/\text{s}$. Calculate the specific energy of water if the depth of flow in the channel is 2m.
(10 marks)
- b) A cement lined rectangular channel 6m wide carries water at the rate of $15\text{m}^3/\text{s}$. Calculate the critical depth and critical velocity.
(10 marks)

QUESTION FIVE

- a) Discuss water hammer. (3 marks)
- b) Water is supplied to a turbine through a pipe of 3km long. Water flows in the pipe with a velocity of 2m/s. A valve near the turbine end is closed in 30 seconds. Calculate the rise in pressure behind the valve. (7 marks)
- c) A valve at the output pipe is suddenly closed to bring the water to rest, which was flowing at 3m/s. Calculate the pressure increase due to sudden closure of the valve. Take k as 2GPa. (10 marks)