



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

ECV 4314: HYDRAULICS I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 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) (30 Marks)

- a) With aid of sketches, differentiate between pumps and turbines and illustrate the energy transfer in pumps and turbines during their operations (6 Marks)
- b) A pump lifts water from a large tank at a rate of 30 l/s. If the input power is 10 kW and the pump is operating at an efficiency of 40%, find:
 - i. the head developed across the pump;
 - ii. the maximum height to which it can raise water if the delivery pipe is vertical, with diameter 100 mm and friction factor $\lambda = 0.015$. (10 Marks)
- c) With aid of sketches, discuss velocity distribution in relation to depth in an open channel flow and highlight at least FOUR factors affecting the velocity distribution (14 Marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

- a) A smooth concrete-lined channel has trapezoidal cross-section with base width 6 m and sides of slope 1V:2H. If the bed slope is 1 in 500 and the normal depth is 2 m calculate the quantity of flow. Manning's n is $0.012 \text{ m}^{-1/3} \text{ s}$.
- b) For the channel above, if the quantity of flow is $40 \text{ m}^3 \text{ s}^{-1}$, what is the normal depth?

QUESTION THREE (20 Marks)

A rotodynamic pump, having the characteristics tabulated below, delivers water from a river at elevation 102 m to a reservoir with a water level of 135 m, through a pipe of length 1 km and diameter 350 mm. The friction factor of the pipe may be taken as $\lambda = 0.035$ and minor losses from valves and fittings can be described by a loss coefficient $K = 9$.

$Q \text{ (m}^3 \text{ s}^{-1}\text{)}$	0	0.05	0.10	0.15	0.20
$H \text{ (m)}$	60	58	52	41	25
$\eta \text{ (%)}$	0	44	65	64	48

- (a) Calculate the discharge and head in the pipeline (at the duty point).

QUESTION FOUR (20 Marks)

An earth drainage ditch may be approximated as a trapezoidal channel with base 0.6 m and side slopes (vertical: horizontal) of 1:2. The streamwise bed slope is 1 in 400 and Manning's n can be assumed to have the value $0.025 \text{ m}^{-1/3} \text{ s}$.

- a) If the depth of water is 0.4 m calculate the discharge.
- b) In the design storm the channel is required to carry away flood water at a rate of $0.8 \text{ m}^3/\text{s}$. Find the depth of water.

QUESTION FIVE (20 Marks)

Define and discuss the types and applications of notches and weirs in open channel flow control/measurement