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

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) (30 Marks)

a) With aid of a sketch outline the pump characteristics of a centrifugal pump (12 Marks.)

b) Outline *three* advantages of having pumps in parallel (6 Marks)

c) With aid of sketches, illustrate the difference between, Radial, Axial and Mixed- Flow devices (12 Marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION

QUESTION TWO (20 Marks)

(a) State atleast FIVE Applications of Hydraulic Jump

(b) With aid of sketches, derive the general friction law equation $V = \sqrt{\frac{2g}{c_f} R_h S}$

for a normal flow in an open channel, where V, R_h, S and C_f are the average velocity, hydraulic radius, streamwise slope and the skin-friction coefficient over the cross-section respectively.

QUESTION THREE (20 Marks)

A V-shaped channel with sides sloping at 30º to the horizontal has a gradient of 1 in 100 and an estimated Manning's n of 0.012 $m^{-1/3}$ s. Calculate: (17 Marks)

(a) the discharge for a depth of 0.5 m;

(b) the depth when the discharge is 2 $m^3 s^{-1}$.

(c) State three factors to be considered in design and choice of a pump. (3 Marks)

QUESTION FOUR(20 Marks)

With aid of sketches, derive the Gradually varied equation

$$\frac{dh}{dx} = \frac{S_0 - S_f}{1 - Fr^2}$$

Where S_o, S_f and F_r are the downward slope of the channel bed, the downward slope of the energy grade line (friction slope) an Froude number respectively.

QUESTION FIVE(20 Marks)

a) With aid of sketches, discuss the use of pumps in parallel and in series(12Marks).

b) With aid of a sketch, illustrate the meaning of a *duty point* as regards to pump operations (8 Marks).