TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

TCV 4325 and ECV 4509: HYDRAULICS II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MARCH 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

a) A horizontal pipe of $1mm\ \phi$ is obstructed by a circular plate of $100mm\ \phi$. Calculate the loss of head during the obstruction in the pipe, if the water is flowing with a velocity of 1.5m/s in the pipe. $Take\ C_c\ as$ 0.6.
(10 marks)

b) Outline the two main assumptions used in handy cross method complete with diagrams.
(10 marks)

c) A Pelton wheel develops 2000kW under a head of 100m and with an overall efficiency of 85%. Calculate the ϕ of nozzle if the coefficient of velocity for the nozzle is 0.98.

(10 marks)

QUESTION TWO

a) A Pelton when is required to generate 3750kW under an effective head of 400m. Calculate the total flow in l/s and size of the jet. Assume generator efficiency $95\%, \eta_0 = 80\%, C_v = 0.97$. Speed ratio 0.46. If the jet ratio is 10, calculate the mean ϕ of runner. (15 marks)

b) Two horizontal plates are placed 12.5mm apart, the space between them being filled with oil of viscosity of 14 poise. Calculate the shear stress in the oil if the upper plate is moved with a of 2.5m/s.

(5 marks)

QUESTION THREE

a) State the Newtons law of resistance (4 marks)

b) Give the mathematical expression and state the terms. (6 marks)

c) A Pelton when having semi circular buckets and working under a head of 140m, is running at 600 r.p.m. The discharge through the nozzle is 500l/s and ϕ of the wheel is 600mm. Calculate;

i. Power available at the nozzle.

ii. Hydraulic efficiency of the wheel if $C_v = 0.98$. (10 marks)

QUESTION FOUR

a) Sate 3 assumptions that the above law is based. (12 marks)

b) A smooth plate 1m wide and 3m long moves through stationary air with a velocity of 3m/s. Determine the thickness of the boundary layer at the trailing edge. Assume for air as 0.15 stroke

(5 marks)

c) Define turbulent flow. (3 marks)

QUESTION FIVE

a) A centrifugal has an external and internal impeller. The vane angle at inlet and outlet are $30°$ *and* $45°$ respectively. If the water enters the impeller at 2.5m/s, calculate;

i. Speed of the impeller in r.p.m.

ii. Work done in kN of water. (15 marks)

b) State Manometric head. (5 marks)