



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4509 : HYDRAULICS II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2024
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 **four** questions.

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

Do not write on the question paper.

QUESTION ONE

- a) A flat plate $1.5\text{m} \times 1.5\text{m}$ moves at 45 km/hr in stationary air of specific weight 11.3 N/m^3 . If the coefficients of drag and lift are 0.15 and 0.75 respectively. Calculate;
- (i) Lift force
 - (ii) Drag force
 - (iii) Resultant force
 - (iv) Power required to keep the plate in motion. **(12 marks)**
- b) Briefly explain the boundary layer theory. **(8 marks)**

- c) A centrifugal pump having an overall efficiency of 62%, is required to handle brine (sp. gr. = 1.19) and gasoline (sp. gr. = 0.7). The discharge of each of these liquids is 50 l/s against a net pressure of 400 kPa. Show that the same power is required for handling both the above liquids having different specific gravity.

(10 marks)

QUESTION TWO

- a) A centrifugal pump is required to lift water to a total head of 40m at the rate of 50 l/s. Determine the power required for the pump, if its overall efficiency is 62%.
- b) A pelton wheel having semi-circular bucket and working under a head of 140m is running at 600 r.p.m. The discharge through the nozzle is 500 l/s and the diameter of the wheel is 600mm. Calculate the hydraulic efficiency of the wheel, if the coefficient of velocity is 0.98.

(7 marks)

(13 marks)

QUESTION THREE

- a) A Pelton wheel, working under a head of 500m produces 13,000kN at 430 r.p.m. If the efficiency of the wheel is 85%, determine;
- (i) Discharge of the turbine.
- (ii) Diameter of the wheel.
- (iii) Diameter of the nozzle. (*Assume suitable data*).
- b) Water is flowing through a pipe 1,500m long with a velocity of 0.8 m/s. Calculate the diameter of the pipe, if the loss of head due to friction is 87m. (*Take f for the pipe as 0.01*).

(10 marks)

(10 marks)

QUESTION FOUR

- a) State Newton's Law of Resistance.
- b) Briefly explain TWO assumptions that are based on the above law.
- c) Briefly using relevant sketch, derive expression for Pascal's law.
- d) A pipe of 40mm diameter is conveying water with a velocity of 2.5 m/s. Calculate the loss of head at the entrance and exit of the pipe.

(6 marks)

(5 marks)

(4 marks)

(5 marks)

QUESTION FIVE

- a) (i) Define Pascal's Law.
- (ii) Briefly explain TWO components important in Pascal's Law formulation.

(2 marks)

(4 marks)

- b) A man weighing 750N descends to the ground from an aeroplane with the help of a parachute against the resistance of air. The shape of the parachute is hemispherical of 2m diameter. Determine the velocity of the parachute with which is coming down. (*Take Specific Weight of the air as 12 N/m^3*). **(9 marks)**
- c) State Assumptions made in derivation of Pascal's Principle. **(5 marks)**