



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

INSTITUTIONAL BASED PROGRAMME

**BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
- YEAR III**

EME 4306: FLUIDS MECHANICS II

SEMESTER I EXAMS

TIME: 2 HRS

INSTRUCTION TO CANDIDATES

You should have the following for this examination:-

- Answer booklet
- Drawing instruments
- Scientific Calculator

This paper consists of FIVE questions

Answer THREE questions

All questions carry equal marks.

Maximum marks for each part of a question are as shown.

Question One

a) Explain the following non-uniform flow in open channels terms

- i. Rapidly varied flow
- ii. Gradually varied flow (4 marks)

b) Derive the following expression for discharge through a channel by chezy's formula.

$$Q = A \times C \sqrt{mi}$$

Where Q =discharge, A =Area of flow of water, C = Chezy's constant , m =hydraulic mean depth i =slope of the bed of the channel (10 marks)

- c) Find the velocity of flow and the rate of water through a rectangle channel. Of 6 m wide and 3 meter deep, when it is running full. The channel is having bed slope as 1 in 2000. Take the chezy's constant $C= 55$. (6 marks)

Question Two

- a) Define Dimensional Analysis and four of its uses. (6 marks)
- b) State four advantages of dimensional analysis (8 m arks)
- c) Determine the dimensions of the following quantities.
- Discharge
 - Force
 - Specific weight
- (6 marks)

Question Three

- a) Explain the following types of flow
- Steady uniform flow
 - Unsteady non-uniform flow (4 marks)
- b) Show that the for work done by a force exerted by a water jet on a moving plate inclined in the direction of the jet is given by

$$F_x = aV^2 \sin^2 \theta$$

Where

ρ = density, a = area of the jet , V = velocity of the jet, θ = *inclination of the plate with the jet* (8 marks)

- c) A nozzle of 60mm diameter delivers a stream of water at 24m/s perpendicular to a plate that moves away from the jet at 6 m/s. Calculate
- The force on the plate
 - The work done
 - Efficiency of the jet. (8 marks)

Question Four

- a) Derive an expression for the velocity distribution for viscous flow between two parallel plates and also sketch the velocity distribution and shear stress distribution across the section. (14 marks)

- b) An oil of viscosity 0.02 NS/m^2 flowing between two stationary parallel plates 1M wide maintained 10mm apart. The velocity mid way between the plates is 2 m/s. Calculate
- i. The pressure gradient along flow.
 - ii. The average velocity
 - iii. The discharge. (6 marks)

Question Five

- a) Describe the following types of flow
- i. Steady flow
 - ii. Laminar flow
 - iii. Compressible flow (6 marks)
- b) Explain the water hammer phenomenon. (3 marks)
- c) A 25 cm diameter pipe carries oil of specific gravity of 0.9 at a velocity of 3 m/s. At another section the diameter is 20 cm. Find the velocity at this section and also mass rate flow of oil. (5 marks)
- d) State four factors of which the pressure rise due to water hammer depends. (6 marks)