



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**THE DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING**

**EMG 2301 : FLUID MECHANICS II**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: Pick Date May 2016**

## 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 any **THREE** questions.

**Do not write on the question paper.**

## Question ONE

### Question One

- a) Explain the following non-uniform flow in open channels terms
- Rapidly varied flow
  - 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 1in 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 marks)
- c) Determine the dimensions of the following quantities. (6 marks)
- Discharge
  - Force
  - Specific weight

## Question THREE

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

$$F_x = \rho a V^2 \sin^2 \theta$$

Where

$\rho$  = density,  $a$  = area of the jet,  $V$  = velocity of the jet,  $\theta$  = 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. (12 marks)
- b) An oil of viscosity 0.02 NS/m<sup>2</sup> flowing between two stationary parallel plates 1M wide maintained 10mm apart. The velocity mid way between the plates is 2 m/s. Calculate
- The pressure gradient along flow.

- ii. The average velocity
- iii. The discharge .

(8 marks)

### Question FIVE

- a) Define the terms:
  - i. Major energy losses in pipe
  - ii. Minor energy losses in pipe. (6 marks)
- b) A horizontal pipe 150 mm in diameter is joined by a sudden enlargement to a 225 mm diameter pipe. Water is flowing through it at the rate of  $0.05\text{m}^3/\text{s}$ . Find:
  - i. Loss of head due to abrupt expansion
  - ii. Pressure difference in the two pipes.
  - iii. Change in pressure if the change of section is gradual without any loss. (9 marks)
- c) Explain the term water hammer and state factor in which its magnitude depends on (5 marks)