



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)
- i. Discharge
 - ii. Force
 - iii. Specific weight

Question THREE

- a) Explain the following types of flow
- i. Steady uniform flow
 - ii. 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

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
- i. The force on the plate
 - ii. The work done
 - iii. 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^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 .

(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)