TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE IN BACHELOR OF SCINCE 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

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 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 m arks)

c) Determine the dimensions of the following quantities.

i. Discharge
ii. Force
iii. Specific weight (6 marks)

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 at the rate of 0.05m3/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)