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 2307 : FLUID MECHANICS III

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

a) Define the following functions
   i.   Velocity potential function
   ii. Stream function.   (6 marks)
b) A fluid flow field is given by $V = x^2yi + y^2zj + (2xyz + yz^2)k$
   Calculate the velocity and acceleration at the point (2,1,3)   (9marks)
c) A stream function is given by $\psi = 5x - 6y$
   Calculate the velocity components and also magnitude and direction of the resultant at any point.
                                                                                 (5 marks)

Question TWO

a) Explain compressible flow and incompressible flow   (4 marks)
b) Derive the expression for Bernoulli's equation when the process is isothermal   (6 marks)
c) A 120mm diameter pipe reduces to 60mm diameter through a sudden contraction. When it carries air at 25ºC under isothermal condition, the absolute pressure observed in the two pipes just before and after the contraction are 480kN/m^2 and 384KN/m^2 respectively, calculate:

    i.   Densities at the sections.

    ii.   Velocities at the two sections

    iii.   Mass rate of flow through the pipe   (10 marks)

Question THREE

a) Explain the following flows:
    i.   Forced vortex flow
    ii.   Free vortex flow   (6 marks)

b) An open cylinder of 15cm diameter and 100 cm long contains water up to a height of 80 cm. Find the maximum speed at which the cylinder is to be rotated about its vertical axis so that no water spills.
                                              (7marks)

c) A cylindrical vessel 12cm in diameter and 30 cm deep is filled with water upto the top. The vessel is open at the top. Find the quantity of liquid left in the vessel, when it is rotated about its vertical axis with a speed of 300rpm.   (7 marks)

Question FOUR

a) Describe the following efficiencies of a turbine
    i.   Hydraulic Efficiency
    ii.   Mechanical Efficiency
    iii.   Volumetric Efficiency
    iv.   Overall Efficiency   (6 marks)

b) Draw a schematic diagram of a Francis turbine and explain briefly its construction and working.
                                             (9 marks)

c) State advantage of a Francis turbine over Pelton wheel   (5 marks)

Question FIVE

a) What is a pump?   (3 marks)

b) State any six advantages of a centrifugal pump over a displacement (reciprocating) pump. (6 marks)

c) List the main components parts of a centrifugal pump and explain them briefly   (11 marks)