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) Explain the following terms
   i.   Path line
   ii.   Stream line
   iii.   Stream line
   iv.   Stream tube   (8 marks)

b) A fluid flow field is given by $V = (3x + 2y)i + (2z + 3x^2)j + (2t - 3z)k$
   Determine
       i.   The velocity components u,v,w at any point in the field.
       ii.   The speed at point (1,1,1)
       iii.   The speed at time t=2s at point 0,0,2)   (6 marks)

c) For the following stream functions calculate velocity at point (1,2)
       i. $\psi = 3xy$
       ii. $\psi = 3x^2y - y^3$ (6 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 25^oC 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) Sketch the layout of hydroelectric power plant   (7 marks)

    b) Explain the following terms related to efficiency of pelton wheel:

       i. Mechanical efficiency

       ii. Volumetric efficiency

       iii. Overall efficiency   (6 marks)

(c) A pelton wheel having a mean bucket diameter of 1.2m is running at 1000 r.p.m. The net head on the pelton wheel is 840m. If the side clearance angle is 15^0 and discharged through the nozzle is 0.12m^3/s. Calculate:

    (i) Power available at the nozzle

    (ii) Hydraulic efficiency of the turbine   (7 marks)

Question FIVE

    a) What is a pump?   (3 marks)

b) Describe the principle and working of a reciprocating pump. (8mark)

c) A single acting reciprocating pump running at 50 r.p.m. delivers 0.00736 m3/s of water .The diameter of the piston is 200 mm and stroke length 300mm.The suction and delivery heads are 3.5 and 11.5 respectively. Calculate.

     i. Theoretical discharge

     ii. Co-efficient of discharge.

     iii. Power required to run the pump. (9 marks)

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