TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MECHNICAL ENGINEERING

EME 2305 : FLUIDS 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 Choose No questions. Attempt Choose instruction.

Do not write on the question paper.

Question ONE

a) Define the following;

I. Kinematic similarity
II. Geometric similarity
III. Dynamic Similarity

6 marks

b) Explain clearly Buckigham's π –theorem method of dimensional Analysis. 3 marks

c) The thrust force, F generated by a propeller is found to depend on the following parameters: diameter **D**, forward velocity **u**, density **ρ**, viscosity **μ** and rotational speed **N**.
Determine the dimensionless parameters to correlate the phenomenon.

11 marks

Question TWO

a) Show that $\Delta P = \frac{128\mu LQ}{\pi D^4}$

Where; ΔP is the pressure drop
μ is the dynamic viscosity,
L is the length of the pipe,
Q is the discharge
D is the diameter

16 marks

b) Oil flows at the rate of 3 l/s through a pipe of 50 mm diameter. The pressure difference across a length of 15 m of the pipe is 6 kPa. Determine the viscosity of oil flowing through the pipe.

4 marks

Question THREE

a) A plunger of 0.08m diameter and length 0.13m has four small holes of diameter 5/1600 m drilled through in the direction of its length. The plunger is a close fit inside a cylinder, containing oil, such that no oil is assumed to pass between the plunger and the cylinder. If the plunger is subjected to a vertical downward force of 45N (including its own weight) and it is assumed that the upward flow through the four small holes is laminar.

I. Sketch the arrangement 5 marks

II. Determine the speed of the fall of the plunger.
The coefficient of velocity of the oil is 0.2

8 marks

b) The velocity distribution of a viscous liquid (dynamic viscosity μ = 0.9 Ns/m^2) flowing over a fixed plate is given by u = 0.68y - y2
(u is velocity in m/s and y is the distance from the plate in m).

Calculate the shear stresses at the plate surface and at y=0.34m?

7 marks

Question FOUR

a) The diameter and width of a contrifugal pump impeller are 50 cm and 2.5 cm. The pump runs at 1200 rpm. The suction head is 6 m and the delivery head is 40 m. The frictional drop in suction is 2 m and in the delivery 8 m. The blade angle at out let is 30°. The manometric efficiency is 80% and the overall efficiency is 75%.

I. Determine the power required to drive the pump.
II. Calculate the pressures at the suction and delivery side of the pump.

10 marks

b) A centrifugal pump has been designed to run at 950 rpm delivering 0.4 m^3/s against a head of 16 m. If the pump is to be coupled to a motor of rated speed 1450 rpm.
Calculate the
I. discharge,
II. head
III. power input**.**
Assume that the overall efficiency is 0.82 remains constant.

10 marks

Question FIVE

a) Sketch a reciprocating pump showing its main parts and describe its operation.

12 marks

b) In a single acting reciprocating pump with plunger diameter of 120 mm and stroke of 180 mm running at 60 rpm, an air vessel is fixed at the same level as the pump at a distance of 3 m. The diameter of the delivery pipe is 90 mm and the length is 25 m. Friction factor is 0.02
Determine the reduction in accelerating head and the friction head due to the fitting of air vessel

8 marks