THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of engineering &technology

Department of mechanical & automotive engineering

DIPLOMA IN
MECHANICAL ENGINEERING
AUTOMOTIVE ENGINEERING
PRODUCTION ENGINEERING

EME 2302
FLUID MECHANICS I

YEARIII- SEMESTER I
SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to candidates

You should have the following for this examination:

- Answer Booklets
- Scientific Calculator
- Drawing Paper
- Drawing Instruments

This paper consists of **FIVE** questions.
Answer questions **ONE** and any **TWO** other questions.
Maximum marks for each part of the question is shown
This paper consists of ***THREE printed pages.***

QUESTION ONE

(a) Define the following terms as applied to fluid flow:

(i) Steady flow

(ii) Uniform flow

(4 Marks)

(b) (i) Name **TWO** causes of head loss in fluid flow through pipe.

(ii) Fluid due to sudden enlargement in pipe cross-section is given by :-

$h = \frac{(V_1 - V_2)^2}{2g}$ where V_1 is velocity is smaller pipe and V_2 is the larger pipe downstream of function.

(13 Marks)

(c) Two water reservoirs whose difference in level is 15m are connected by a pipe 40m long. The first 20m of the pipe from the tank is 40mm in diameters while the next 20m is 60mm in diameter. Calculate the rate of flow. For both pipes friction factor f = 0.05H. Assume no losses at entry to and exit from the pipe. **(13 Marks)**

QUESTION TWO

(a) Define t he following terms marring one example for each:-

(i) Fundamental dimension
(ii) Derived dimensions

(6 Marks)

(b) The variables controlling motion of a floating vessel through water are known to be the drag force F, Speed of advance μ , length L, density ρ, dynamic viscosity μ and gravitational acceleration g. Show by dimensional analysis, that a possible relationship between the drag force and the other variables is $F = \rho u^2 l^2 \phi\left(\frac{\rho u l}{\mu}, \frac{u}{\sqrt{eg}}\right)$ **(14 Marks)**

QUESTION THREE

(a) Define the following terms as applied to fluid flow:-

(i) Laminar flow
(ii) Turbulent flow

(4 Marks)

(b) Two reservoirs are connected by a pipe whose total length is 360m. From the upper reservoir the pipe is 300mm in diameter for a length of 150m. While the remaining 2.10m is 450mm in diameter. The velocity of water in the smaller pipe is 12m/s.

Calculate:

(i) The loss of head in the junction.
(ii) The loss of head at entry to the pipe.
(iii) The loss of head at exit to the lower reservoir
(iv) The difference in levels of water in the two reservoirs.

(16 Marks)

QUESTION FOUR

(a) Show that the velocity of an element of fluid of thickness by flowing through fixed parallel plates is given by:

$u = \frac{P}{2\mu l}\left(h^2 - y^2\right)$ and

hence that the discharge through the plates is $Q = \frac{Pbh^2}{2\mu L}$

where:

P = Pressure drop
b = Width of the plates
y = Distance of fluid element from bottom plate
l = Length of plates
μ = Dynamic viscosity

(12 Marks)

(b) The radial clearance between the plunger and the walls of a cylinder is 0.08mm. The length of the plunger l =250mm, diameter of plunger 100mm. the difference in pressure of the water on the two ends of the plunger is 200kNm^{-2}. The viscosity of water $\mu = 1.31\times10^{-3}\, kgN^{=1}s^{-1}$. treating the flow as if occurred between parallel plates. Calculate the leakage past the plunger in litres per second. **(8 Marks)**

QUESTION FIVE

(a) Sketch the lift pump and describe its operation. **(8 Marks)**

(b) Sketch the indicator diagram for a single cylinder reciprocating pump. Show clearly the effect of acceleration and friction in both suction and delivery pipes. **(6 Marks)**

(c) Explain why the available lift for a reciprocating pump is limited to only about 8m when pumping water instead of the equivalent atmospheric pressure head of 10.4m. **(6 Marks)**