THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

BRIDGING IN HIGHER DIPLOMA

EBC 2206: FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATON

SERIES: FEBRUARY/MARCH 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Electronic Calculator*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** from section **A** and any other **TWO** from section **B**

Maximum marks for each part of a question are as shown

This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY – 30 MARKS)

Question 1

a) Define the following terms:
   (i) Mass
   (ii) Force
   (iii) Weight
   (iv) Hydrostatics
   (v) Intensity of pressure
   (vi) Fluid (12 marks)

b) A certain liquid has a relative density of 1.0. Determine in SI units the:
   (i) Volume of 200kg of the liquid
   (ii) Unit weight of the liquid
   (iii) Mass density of the liquid
   (iv) Mass of $1.5m^3$ of the liquid (8 marks)

SECTION B (Attempt any TWO questions from this section – 20 marks each)

Question 2

a) An inverted differential manometer is fitted between two pipes A and B containing two different liquids as shown in figure 1. Determine the difference in pressure between pipes A and B.
   (i) In N/m^2
   (ii) In metres of water
   (iii) In Kpa (9 marks)

Figure 1

b) State **THREE** properties of a manometer liquid for a simple u-tube manometer (3 marks)

c) Differentiate the following
   (i) Atmospheric pressure
   (ii) Gauge pressure
   (iii) Absolute pressure
   (iv) Perfect vacuum (8 marks)

Question 3

a) Figure 2 shows a gate AB which is part of a circle of radius 3m.

A

Determine:
   (i) The resultant pressure on the gate per metre length
   (ii) The angle at which the resultant acts (8 marks)

b) A circular gate 1m diameter is immersed in water as shown in figure 3

Fig 3

Determine:

   (i) The total pressure on the plate
   (ii) The depth at which the total pressure acts (8 marks)

c) With the aid of a sketch, explain the principle of a mercury barometer (4 marks)

Question 4

a) Two pipes A and R of dia 30cm and 20cm respectively join to form a single pipe P of 450mm dia. The velocity in P is 3m/s and Q is 2.5m/s as shown in figure 4.

Fig 4

Determine:

(i) Discharge in Pipe P
(ii) Velocity in pipe R
(iii) Discharge in pipe R (8 marks)

An oil with a specific gravity of 0.8 if flowing in a circular pipe at a rate of 2000 l/s with a velocity of 3m/s. Determine:

(i) The diameter of the pipe
(ii) The mass flow rate of the oil (6 marks)

b) State:

(i) Bernoulli's theorem
(ii) Assumptions made in deriving Bernoulli's equation (6 marks)

Question 5

a) With the aid of sketches, briefly describe the THREE conditions of equilibrium of a solid body (9 marks)

b) Define the following terms

(i) Buoyancy
(ii) Centre of buoyancy
(iii) Metacentric height
(iv) Metacentre (8 marks)

c) State Archimede's principle (3 marks)