THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING

EBC 2206: FLUID MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 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 any **THREE** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **FOUR** printed pages

Question 1 (20 marks)

a) Define the following terms giving their SI units where appropriate.
    (i)   Mass
    (ii)   Weight
    (iii)   Pressure
    (iv)   Ideal fluid
    (v)   Energy
    (vi)   Kinematic viscosity   (12 marks)

b) A certain solid with a mass of 400kg has a volume of $0.5m^3$. Determine:

    (i)   Its mass density
    (ii)   The mass of $5m^3$ of the solid
    (iii)   The weight of $0.5m^3$ of the solid
    (iv)   Whether the solid will float or sink or sink in water   (8 marks)

Question 2 (20 marks)

a) For the manometer shown in figure 1 determine the difference in pressure between A & B in
    (i) N/M^2
    (ii)   M of water   (9 marks)
    (iii)   KPa

Figure 1

b) State **THREE** desirable properties of a manometer liquid suitable 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 (20 marks)

a) A rectangular plate is immersed in water as shown in figure 2. Determine:

Figure 2

(i) Total pressure on one side of plate
(ii) The position of centre of pressure   (8 marks)

b) A tainter gate AB 3m long is mounted on a spillway as shown in figure 3

Figure 3

Determine:
i) Total pressure on the gate AB
ii) The angle at which the total pressure acts.   (10 marks)

c) Differentiate a piezometer from a barometer   (2 marks)

Question 4 (20 marks)

a) A siphon has a uniform bore of 50mm diameter and consists of a bent pipe with its crest 1.9m above water level discharging into the atmosphere at a level 4m below water level. The atmospheric pressure is equivalent to 10m of water. If losses due to friction are neglected, determine the;

(i) Velocity of flow
(ii) Discharge through the siphon
(iii) Absolute pressure at the crest   (8 marks)

b) Three pipes 1, 2 and 3 feed a 50mm diameter pipe (4) which later branches into two pipes 5 & 6 as shown in figure 4. Important data of diameter d, velocity v and discharge q are shown in the figure. Determine:
   (i)   Discharge in pipe 4
   (ii)   Velocity in pipe 5
   (iii)   Diameter of pipe 6   (8 marks)

$d_1 = 15mm$
$V_1 = 0.45m/s$

c) (i) State Bernoulli's theorem
   (ii) State **TWO** assumptions assumed in deriving Bernoulli's theorem   (4 marks)

Question 5 (20 marks)

a) Define the following terms
        (i)   Metacentric height
        (ii)   Centre of buoyancy
        (iii)   Point velocity   (6 marks)

b) With the aid of a sketch, briefly explain the **THREE** conditions of equilibrium of a solid body
                                                                                              (9 marks)
c) Sketch and label a pitot static tube   (5 marks)