

# 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

**SPECIAL/SUPPLEMENTARY EXAMINATION**

SERIES: MAY/JUNE 2012

**TIME: 2 HOURS**

## **Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

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 (Compulsory – 20 marks)**

- a) 6800kg of a certain substance has a volume of  $0.5\text{m}^3$ . Determine:
- (i) Its mass density
  - (ii) Its unit weight
  - (iii) The volume of 800 kg of the substance
  - (iv) Whether the substance will float or sink in water (8 marks)
- b) Define the following terms, giving their SI units
- (i) Force
  - (ii) Mass
  - (iii) Energy
  - (iv) Power (8 marks)
- c) State **FOUR** desirable properties of a manometer liquid for an inverted U-tube manometer (4 marks)

**Question 2 (20 marks)**

- a) The pressure in a pipe at m is measured by an open manometer as shown in figure 1.

Mercury

Determine

- (i) Gauge pressure at m
  - (ii) Absolute pressure at M if atmospheric pressure is  $101.3\text{KN/m}^2$  (8 marks)
- b) Define the following terms:
- (i) Buoyancy
  - (ii) Metacentre
  - (iii) Centre of buoyancy
  - (iv) Metacentric height (8 marks)
- c) With the aid of a sketch, briefly describe the term neutral equilibrium of a solid body (4 marks)

**Question 3 (20 marks)**

a) A circular plate is immersed in water as shown in figure 2.

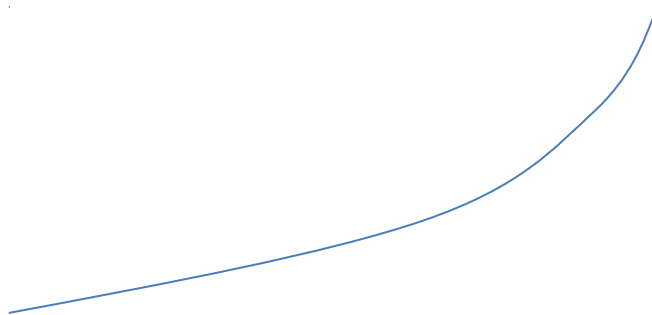
2m

Determine:

- (i) The total pressure on one face of the plate
- (ii) The depth of total pressure

(10 marks)

b) The curved gate AB is circular-cylindrical of 1m radius, as shown in figure 3.



Determine:

- (i) The total pressure on gate AB
- (ii) The angle at which the total pressure acts

(10 marks)

**Question 4 (20 marks)**

a) An oil of specific gravity 0.8 is flowing in a pipe at a rate of 2000lps with a velocity of 3m/s.

Determine:

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

(6 marks)

b) Water is flowing through a horizontal pipe AB 100m long. The pipe tapers uniformly from 300mm diameter at A to 200mm diameter at B. The pressure at A is 100 Kpa and the flow rate is 50l/s. Determine the pressure at B in

- (i)  $\text{N/m}^2$
  - (ii) mm of mercury
- (6 marks)

- c) Water is flowing through a pipe BC which forks into two pipes CD and CE as shown.  
 $Q_3 = \frac{1}{2} Q_2$  and other details as shown in figure 4

Figure 4

Determine

- (i) Velocity in BC
  - (ii) Diameter of CD
  - (iii) Discharge  $Q_2$
  - (iv) Discharge  $Q_3$
- (8 marks)

**Question 5 (20 marks)**

- a) (i) State “Bernoulli’s theorem”  
(ii) State **FOUR** assumptions made in deriving Bernoulli’s theorem
- (6 marks)
- b) Define the following terms:
- (i) Uniform flow
  - (ii) Steady flow
  - (iii) Turbulent flow
  - (iv) Laminar flow
- (8 marks)
- c) Sketch and label a pitot static tube
- (6 marks)