



TECHNICAL UNIVERSITY OF MOMBASA  
**Faculty of Engineering &  
Technology**

DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
**DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12M)**

EBC 2208: FLUID MECHANICS I

**SPECIAL/SUPPLEMENTARY EXAMINATION**  
**SERIES: OCTOBER 2013**  
**TIME ALLOWED: 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 as shown

This paper consists of **THREE** printed pages

### Question One

- a) A certain oil has a specific gravity of 0.7. Determine in SI units.
- (i) Its mass density
  - (ii) Its specific weight
  - (iii) The weight of 0.5litres of the oil
  - (iv) The volume of 0.7kg of the oil **(8 marks)**
- b) Define the following terms. **(8 marks)**
- (i) Ideal fluid
  - (ii) Viscosity
  - (iii) Bulk modulus of a liquid
  - (iv) Capillarity
  - (v) Mass
  - (vi) Energy **(12 marks)**

### Question Two

- a) State **THREE** desirable properties of a manometer liquid suitable for an “inverted U-tube manometer” **(3 marks)**
- b) The manometer shown in figure 1 is used to measure the difference in pressure between two water pipe A and B. If the pressure head in pipe A is 2m of water, determine the pressure in pipe B **(9 marks)**

Figure 1

- c) Given that a liquid has a density of  $1.53 \times 10^3 \text{kg/m}^3$  and that atmospheric pressure is equivalent to 750mm of mercury. Determine:
- (i) The absolute pressure at a point 3m below the free surface of the liquid
  - (ii) The gauge pressure at a point 5m below the free surface of the liquid. **(8 marks)**

### Question Three

$$I_g = \frac{\pi d^4}{64}$$

- a) A hollow circular plate is immersed vertically in water as shown in figure 2. Given that  $I_g = \frac{\pi d^4}{64}$  for a circle, determine:
- (i) The total pressure on the plate **(10 marks)**
  - (ii) The depth of the centre of pressure

Figure 2

- b) The gate AB shown in figure 3 is a quadrant of a circular cylinder. If the length of the gate is 2m, determine:
- (i) The total pressure acting on the gate AB
  - (ii) The angle at which the total pressure will act **(10 marks)**

Figure 3

#### Question Four

- a) Define the following terms:
- (i) Buoyancy
  - (ii) Centre of buoyancy
  - (iii) Metacentre
  - (iv) Metacentric height **(8 marks)**
- b) With the aid of sketches, briefly describe the following conditions of equilibrium of a solid body.
- (i) Stable equilibrium
  - (ii) Unstable equilibrium
  - (iii) Neutral equilibrium **(9 marks)**
- c) State Archimedes principle as applied to floating bodies **(3 marks)**

### Question Five

- a) Using usual notations, derive Bernoulli's equation for the flow of an incompressible frictionless liquid. **(14 marks)**
- b) A pipe is conveying water at a rate of  $7200\text{m}^3/\text{hr}$  with an average velocity of  $3\text{m/s}$ . Determine:
- (i) The diameter of the pipe
  - (ii) The mass flow rate **(6 marks)**