# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

## University Examination 2010

### SECOND YEAR/FIRST SEMESTER EXAMINATION
### FOR THE DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING

## ECE 2203: FLUID MECHANICS I

**SERIES:** APRIL/MAY 2010 **TIME:** 2 HOURS

**Instructions:**

You should have the following for this examination:
- Answer booklet.
- Mathematical table/pocket calculator

Question **ONE** is Compulsory. Answer any other **TWO** questions from the remaining four questions.

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**QUESTION ONE**

(a) State some aspects which differentiate fluid from solids. (4 marks)

(b) "U" tube manometer is used to measure pressures. Change in liquid in both sides of a tube manometer must be read. With clear diagrams and calculations, show the advances of a "U" tube manometer, which with only one reading pressures can be measured. (6 marks)

(c) Proof that pressure in liquids acts equally in all directions. (9 marks)

(d) A driver is working at a depth of 18m, below the surface of the sea. How much greater is the pressure intensity at this depth than at the surface. Specific weight of sea-water is 10,000N/$m^3$. (6 marks)

(e) Discuss viscosity as a property of fluid giving all the dimensions and units. (5 marks)

**QUESTION TWO**

(a) Explain with diagrams the general rules of fluid statics. (6 marks)

(b) State the conditions to be met to ensure the stable equilibrium of a body partly immersed in a liquid.

A right solid cone with apex angle equal to 60 degrees is of density K relative to that of the liquid in which it floats with apex downwards. Determine what range of K is compatible with stable equilibrium. (14 marks)

**QUESTION THREE**

(a) Working from basic principles, derive the units and dimensions of dynamic viscosity. (6 marks)

(b) A tank containing water moves horizontally with a constant linear acceleration of $3m/s^2$. The tank is 3m long and the depth of water when the tank is at rest is 1.5m. Calculate:

(i) Angle of the water surface to the horizontal
(ii) The maximum pressure intensity on the bottom
(iii) The minimum pressure intensity on the bottom. (14 marks)

**QUESTION FOUR**

(a) Define the following:

(i) Potential head (1½ marks)
(ii) Pressure head (1½ marks)
(iii) Velocity head (1½ marks)
(iv) Total head for a liquid in motion. (1½ marks)

(b) A jet of water from a 25mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, what will be the diameter of the jet at a point 4.5m above the nozzle if the velocity with which the jet leaves the nozzle is 12m/s. (14 marks)

**QUESTION FIVE**

(a) Derive the Bernoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum. (10 marks)

(b) A siphon has a uniform circular bore of 75mm diameter and consists of a bent pipe with its crest 1.8m above water level discharging into the atmosphere at a level 3.6m below water level. Find the velocity of flow, the discharge and the absolute pressure at crest level if the atmospheric pressure is equivalent to 10m of water. Neglect losses due to friction. (10 marks)