TECHNICAL UNIVERSITY OF MOMBASA

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE ENGINEERING

SECOND YEAR SECOND SEMESTER UNIVERSITY EXAMINATION FOR THE DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (BSME)

EMG 2205
FLUID MECHANICS I

END OF SEMESTER EXAMINATIONS

SERIES: DECEMBER, 2013

TIME: 2 HOURS

INSTRUCTION TO CANDIDATES

1. You should have the following for this examination:-
   - Answer Booklet
   - Scientific Calculator
   - Mathematical Table/Pocket Calculator

2. This paper consists of **FIVE** questions.
3. Answer Question **ONE** is **COMPULSORY** and any other **TWO** Questions.
4. Maximum marks for each part of Question are as shown.
5. This paper consists of **TWO** printed pages.

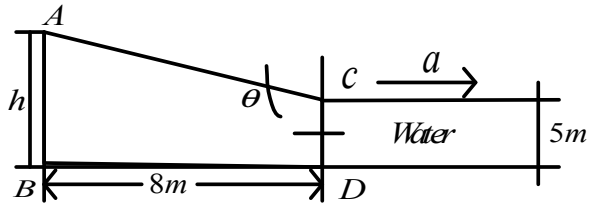
Question ONE (Compulsory)

(a) Discuss compressibility and bulk modulus for fluids and show how they are related to each other. **(5 marks)**

(b) With the use of a diagram show P_{ATM}, P_{ABS}, P_{GAUGE} indicating the datum line, from the absolute zero pressure line and define the terms? **(6 marks)**

(c) Explain Archimedes principle with a diagram representation of it? **(7 marks)**

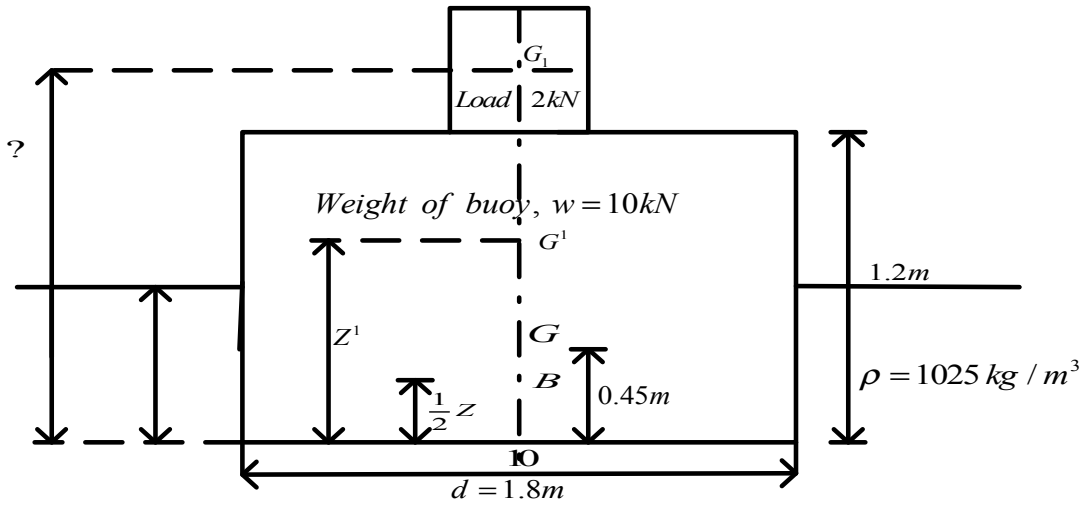
(d) Find the maximum and minimum pressure at the bottom and the angle Θ from the horizontal made by the water surface for a track with water moving with an acceleration a= 6m/s^2.



(12 marks)

Question TWO

A cylindrical buoy 1.8m in diameter, 1.2m high and weighing 10KN floats in salt water of density 1025kgm^{-3}. Its centre of gravity is 0.45m from the bottom. If a load of 2kN is placed on the top, find the maximum height of the centre of gravity of this load above the buoy is to remain in stable equilibrium. **(20 marks)**



Question THREE

Ten nozzles each 25mm in diameter, all inclined at an angle of 45^o with the horizontal are used in an ornamental fountain. The jet issuing from the nozzle falls into a basin at a point 1.5m vertically beneath the nozzle and 4.5m horizontally from it. The velocity co-efficient of nozzle is 0.97. Determine:

(i) Pressure head at the nozzle
(ii) Total discharge from the nozzles

(20 marks)

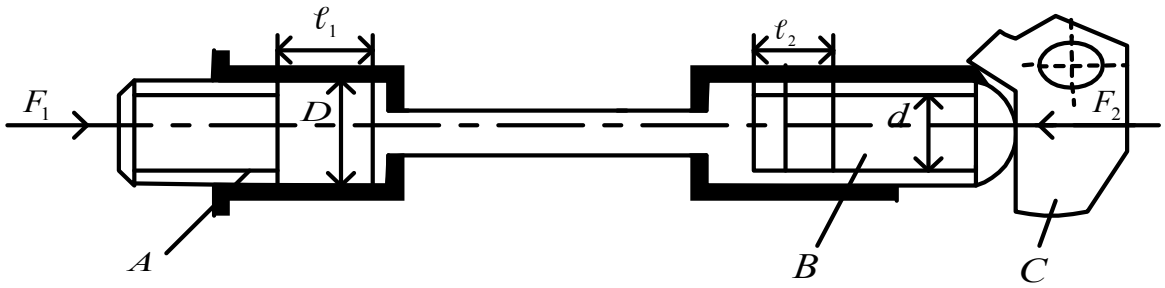
Question FOUR

(a) Illustrate with a diagram an inclined vertical column manometer. **(8 marks)**

(b) Derive the formular for calculating pressure difference using an inclined vertical column manometer. **(12 marks)**

Question FIVE

In a remote hydrocontrol system, it is important to ensure a run of $l_1 = l_2 = l = 32$ mm. Piston B has a diameter d = 20mm and moves lever C with a force $F_2 = 8$kN . The cylinders and piping are filled with oil which has a bulk modulus of elasticity of k = 1400MPa. The volume of the oil poured at atmospheric pressure is $V = 700cm^3$. Find the diameter D of the piston A and the force F_1, applied on the piston A. (Consider negligible) The elasticity of the cylinder walls and pipes and also the friction force of the pistons across the cylinder walls).



(20 marks)