THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2203: FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2012
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Mathematical Table/Pocket Calculator*

This paper consists of **FIVE** questions.

Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (20 marks)

a) State and explain **FOUR** properties of fluids **(8 marks)**

b) Give **TWO** differences between liquids and gases **(4 marks)**

c) State giving units and dimensions the SIX primary units of the SI systems **(6 marks)**

d) Find the head 'h' of water corresponding to an intensity of pressure 'p' of 340,000N/m^2. The mass density 'p' of water is 10^3 kg/m^3 **(4 marks)**

e) A mercury 'U' tube manometer is used to measure the pressure above atmospheric of water in a pipe, the water being in contact with the mercury in the left hand limb. If the mercury is 30cm below A in the left land limb and 20cm above A in the right hand limb, what is the gauge pressure at A?
Specific gravity of mercury, s = 13.6 **(see figure 1 below)** **(8 marks)**

Figure 1

Question Two (20 marks)

a) State **TWO** advantages and **FOUR** disadvantages of manometers. **(6 marks)**

b) A cylindrical buoy 1.35m in diameter and 1.8m high has a mass of 770kg. Show that it will not float with its axis vertical in sea water of density 1025kg/m^3. If one end of the vertical chain is fastened to the base. Find the pull required just to keep the buoy vertical. The centre of gravity of the buoy is 0.9m from its base. **(14 marks)**

Question Three (20 marks)

a) Show that for a submerged vertical surface, the resultant force R is given by ½ PgH^2 **(6 marks)**

b) A vessel containing a liquid of mass density 930kg/m^3 is given a constant vertical acceleration f = 4.8m/s in a upward direction. If the vessel is 1.2m wide and 1.5m in breadth and the depth of the liquid is 0.9m. Calculate the force on the bottom of the vessel.
i) While it is being accelerated **(8 marks)**

ii) When the acceleration ceases and the vessel continues to move at a constant velocity of 6m/s vertically upward. **(6 marks)**

Question Four (20 marks)

a) A cylindrical tank is span at 300rev/min with its axis vertical – The tank is 0.6m high and 45cm diameter and is filled completely with water before spinning. Show that the water surface will take the form of paraboloid when the container is span. **(10 marks)**

b) Also calculate:

i) The speed at which the water surface just touch the top rim and centre bottom of the tank. **(5 marks)**

ii) The level to which the water will return when the tank steps spinning and the amount of water lost. **(5 marks)**

Question Five (20 marks)

a) Derive the Bernoulli's equation **(10 marks)**

b) A jet of water is discharged through a nozzle with an effective diameter'd' of 75mm and a velocity 'V' of 22.5m/s. Calculate the power of the issuing jet. If the nozzle is supplied from a reservoir which is 30m above it, what is the loss of head in the pipe line and nozzle and the efficiency of power transmission. **(10 marks)**