THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF ENGINEERING IN BUILDING & CIVIL ENGINEERING & BACHELOR OF SCIENCE IN CIVIL ENGINEERING

EBC 4207/ECE 2203: FLUID MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions in **TWO** sections **I** & **II**
Answer question **ONE (Compulsory)** and any other **TWO** questions
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION I (Compulsory)

Question 1

a) Proof that Pressure in liquids acts equally in all directions (10 marks)

b) State and explain the **FOUR** major properties of fluids (8 marks)

c) 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 limb. If the mercury is 35cm below A in the left limb and 25cm above A in the right hand limb, compute the pressure at A, given that the Specific Gravity of Mercury is 13.6 (8 marks)

d) Differentiate between liquids and gases (4 marks)

SECTION II (Answer any TWO questions)

Question 2

a) Explain the following terms:
   (i) Uniform flow
   (ii) Steady flow
   (iii) Unsteady flow
   (iv) Mass flow rate (4 marks)

b) Oil flows through a pipe line, which contracts 450mm diameter at A to 300mm diameter at B and then forks, one branch being 150mm diameter discharging at C and the other branch 225mm diameter discharging at D. If the velocity at A is 1.75m/sec and the velocity at D is 3.5mm/sec, calculate the discharges at C and D and the velocities at B and C. (10 marks)

c) Describe the **THREE** conditions in which a solid body can be in equilibrium (6 marks)

Question 3

a) Differentiate between turbulent flow and laminar flow (4 marks)

b) State the Principle of Archimedes. A steel pipeline conveying gas has an internal diameter of 120cm and an external diameter of 125cm. It is laid across the bed of a river, completely immersed in water and is anchored at intervals of 3m along its length. Compute the buoyancy force in newtons per meters run and the upward force in newtons on each anchorage. The density of steel = 7900kg/m^3, the density of water is given as 1000kg/m^3. (10 marks)

c) State any **TWO** advantages and **FOUR** disadvantages of manometers (6 marks)

Question 4

a) A cylindrical buoy 1.35m in diameter and 1.80m high has a mass of 70kg. Indicate whether it will float or not with its vertical axis in the sea water of density 1025kg/m^3. The centre of gravity of the buoy is 0.9m from its base (5 marks)

b) What is meant by the following:
   (i) Potential head
   (ii) Pressure head
   (iii) Velocity head
   (iv) Total head of a liquid in motion (4 marks)

   State Bernoulli's theorem. A jet of water from a 2mm diameter nozzle is directly 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 12.0 m/sec? (7 marks)

c) The velocity components in a fluid flow u, is given by:
   $U = 2xy$; $V = a^2 + x^2 - y^2$ find out whether the flow is possible (4 marks)

Question 5

a) Water is flowing through a pipe having a diameter of 300 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525M/cm^2 and the pressure at the upper end is 9.81N/m^2. Determine the difference in datum head if the rate of flow through the pipe is 40 l/s (6 marks)

b) Define Vortices and describe their characteristics (10 marks)

c) Differentiate between gauge pressure and vacuum pressure (4 marks)