TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATIONS FOR DEGREE IN

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2203: FLUID MECHANICS I

END OF SEMESTER EXAMINATIONS
SERIES: APRIL 2014
TIME: 2 HOURS

INSTRUCTIONS:

– Answer question **ONE (Compulsory**) and any other **TWO.**

This paper consists of Three printed pages

QUESTION 1 (Compulsory)

a) Define the following terms:
   i) Bulk modulus **(2 marks)**
   ii) Gauge pressure **(2 marks)**
   iii) Absolute pressure **(2 marks)**

b) In the figure Q 1 (b) above, the top of an inverted U-tube manometer is filled with oil of specific gravity s_o of 0.98 and the remainder of the tube with water of specific gravity s_w of 1.01, calculate the pressure difference in N/M^2 between two points A and B at the same level at the base of the legs when the difference in water level h is 75mm. **(10 marks)**

c) Describe the **TWO** distinct types of flow clearly with figures. **(3 marks)**

d) Describe the term "continuity of flow" and state the conditions under which it will occur. **(3 marks)**

e) Give the type of flow through a pipe of uniform bore running completely full and describe it. **(3 marks)**

f) Water is flowing along a pipe with a velocity of 7.2 m/s. Express this as a velocity head in metres of water. **(1 mark)**

g) Water in a pipe 36m above sea level is under a pressure of $410KN/m^2$ and the velocity of flow is 4.8m/s.
Calculate the total energy per unit weight reckoned above sea level. **(4 marks)**

QUESTION 2

a) A 20mm diameter pipe forks one branch being 10mm in diameter and the other 15mm in diameter. If the velocity in the 10mm pipe is 0.3m/s and that is the 15mm pipe is 0.6m/s, calculate the velocity in m/s and the rate of flow in cm^3/s in the 20mm diameter pipe. **(10 marks)**

b) Draw a sketch of a Bourdon gauge and explain how it works. **(10 marks)**

QUESTION 3

a) State the principle of Archimedes and explain its application on a floating body. **(10 marks)**

b) i) State the forms of energy which a liquid in motion can possess. **(5 marks)**
ii) Derive expressions for each of these forms. **(5 marks)**

QUESTION 4

a) Derive Banoulli's equation for the flow of an incompressible frictionless fluid from consideration of momentum. **(15 marks)**

b) A siphon has a uniform circular base of 75mm chain 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.
Calculate 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. **(5 marks)**

QUESTION 5

a) A ship floating in sea water displaces $115m^3$.

i) Calculate the weight of the ship if sea water has a density of $1025kg/m^2$. **(3 marks)**

ii) The volume of fresh water of density $1000Kg/m^3$ which the ship would displace. **(5 marks)**

b) State the **THREE** conditions in which a solid body can be in equilibrium. Complete with diagrams. **(12 marks)**