TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE – Y2 S2)

ECE 2203: FLUID MECHANICS I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: JULY 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Scientific Calculator*

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

Question One (COMPULSORY)

a) A cylinder of 100mm ϕ contains a liquid to a depth of 300mm. Calculate the depth of the parabola, which the liquid surface will assume if the cylinder is rotated about its vertical axis at 400r.p.m **(8 marks)**

b) A water tank contains 1.3m deep water. Find the pressure exerted by the water per metre length of the tank. **(9 marks)**

c) Explain the term "continuity flow" and hence show mathematically by an equation. **(5 marks)**

d) Define the following terms:
(i) Coefficient of dynamic viscosity **(2 marks)**

(ii) Surface tension **(2 marks)**
(iii) Density **(2 marks)**
(iv) Compressibility **(2 marks)**

Question Two

a) Find the head h of water corresponding to an intensity of pressure p of 340,00N/m^2.
The specific weight w of water 9.81 x 10^3N/m^3 **(5 marks)**

b) An inverted U-tube manometer is used to measure the difference of water pressure between two points in a pipe:
(i) Sketch the arrangement
(ii) If the manometer you have sketched has air at the top of the tube find the difference of pressure between point B and point A, if the specific weight of water w = 9.81 x 10^3N/m^3, h_1 = 60cm, h = 45cm, h_2 = 180cm. **(15 marks)**

Question Three

A plane surface of area A is totally immersed in a liquid of specific weight w. If this surface is inclined at an angle ϕ to the horizontal and its centroid is at a vertical depth $\bar{y}$ below the free surface, derive an expression for the resultant pressure R on one side of the surface and also for the vertical depth D below the free surface of the centre of pressure. **(20 marks)**

Question Four

a) State the principle of Archimedes and explain its application on a floating body. **(5 marks)**

b) A steel pipeline conveying gas has an interval ϕ of 120cm and external ϕ 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. Calculate the buoyancy force in newtons per metre run and the upward force in newtons on each anchorage:
Density of steel = 7900kg/m^3
Density of water = 1000kg/m^3 **(15 marks)**

Question Five

a) Define the following terms used in connection with the flow of a fluid:
(i) Uniform flow
(ii) Steady flow
(iii) Unsteady flow
(iv) Mean velocity
(v) Discharge **(10 marks)**

b) Water in a pipeline 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 wt reckoned above sea level. **(10 marks)**