TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE – Y2 S1)

ECE 2203: FLUID MECHANICS I

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2014
TIME ALLOWED: 2 HOURS

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

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 **FOUR** printed pages

Question One (COMPULSORY)

a) Discuss the following fluid properties and their SI units:
- **(i)** Dynamic viscosity
- **(ii)** Mass density
- **(iii)** Specific gravity **(6 marks)**

b) Figure 1(b) shows a fuel gauge for a gasoline tank in a car which reads proportional to the bottom gauge. The tank is 30cm deep and accidently contains 1.8cm of water in addition to the gasoline. Determine the height of air remaining at the top when the gauge erroneously reads full. Take:

- ω gasoline = 6.65KN/m^3
- ω air = 0.0118KN/m^3 **(8 marks)**

c) Determine the mass discharge of air through a tube with a smooth circular entrance and a cylindrical part of a diameter 200mm, if the measure of vacuum pressure in the form of a vertical column of water h = 250mm. $\rho\ air = 1.25kg/m^3$ and coefficient of loss at the entrance is $\xi = 0.1$. Refer to figure 1 c. **(16 marks)**

Figure 1 (c)

Question Two

A right solid cone with apex angle 60^o is of density K relative to that of the liquid in which it floats with apex downwards. Determine what range of K is compatible with stable equilibrium. Refer to figure 2.

(20 marks)

Figure 2

Given:

R	=	Radius of baseline of cone
D	=	Vertical height of cone
r	=	Radius of waterline plane
d	=	Depth immersed

Question Three

Gasoline (sp.gr 0.8) is flowing upwards a vertical pipeline which tapers from 300mm to 150mm diameter. A gasoline mercury differential manometer is connected between 300mm and 150mm pipe sections to measure the rate of flow. The distance between the manometer tappings is 1 metre and gauge reading is 500mm of mercury. Find:

(i) Differential gauge reading in terms of gasoline head
(ii) Rate of flow

Neglect friction and other losses between tappings refer to figure 3 **(20 marks)**

Figure 3

Question Four

a) Explain the following terms:
- **(i)** Potential head
- **(ii)** Pressure head
- **(iii)** Velocity head
- **(iv)** Total head **(8 marks)**

b) A pipeline carrying oil (sp.gr. 0.8) changes in diameter from 300m at position 1 to 600mm diameter at position 2 which is 5m at a higher level. If the pressure at point 1 and 2 are $100KN/m^2$ and $60KN/m^2$ respectively and the discharge is 300 litres/sec. Determine:
- **(i)** Loss of head and
- **(ii)** Direction of flow **(12 marks)**

Question Five

A moulding in a cylindrical skirt was rotated along its vertical axis. As a result, the shape changed with a inner radius r, less than the upper outer radius r_2. Determine the difference of the radii ($r_2 - r_1$) given that the height of the skirt H = 0.5m, the angular velocity of rotation $\omega = 200s^{-1}$ and diameter D = 200mm. NB: That at the beginning the cylindrical skirt was 30% full. Refer to figure 5 **(20 marks)**