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 2212: FLUID MECHANICS II

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

INSTRUCTIONS:

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

This paper consists of Four printed pages

QUESTION 1 (Compulsory)

a) Mention **FIVE** practical applications of Bernoulli's equation. **(5 marks)**

b) Derive the formula for shock loss at sudden contraction. **(13 marks)**

c) A rectangular tank has compartments 1 and 2, communicating by an orifice 100mm square in shape. Its centre being 1m above the bottom of the tank. The horizontal cross-sections of the compartments 1 and 2 are $12m^2$ and $24m^2$ respectively. At a certain instant the water stands 4m deep in 1 and 2m deep in 2. How soon thereafter will their surface reach a common level.
Take the coefficient of discharge, Cd = 0.6 **(12 marks)**

Reference diagram Figure 1 (c)

QUESTION 2

A 0.4m x 0.3m, 90^0 vertical bend carries 0.5m 3/s oil of specific gravity 0.85 with a pressure of $118kN/m^2$ at inlet to the bend. The volume of the bend is $0.1m^3$. Find the magnitude and direction of the force on the bend. Neglect friction and assume both inlet and outlet sections to be at the same horizontal level . Also assume that water enters the bend at 45^0 to the horizontal.

Reference diagram Firgure 2

QUESTION 3

a) Determine the rate of flow of water through a pipe 300mm diameter placed in an inclined position where a venturimeter is inserted, having a throat diameter of 150mm. The difference of pressure between the main and throat is measured by a liquid of sp. Gravity 0.7 in an inverted U-tube which

gives a reading of 260mm. The loss of head between the main and throat is 0.3 times the kinetic head of the pipe. **(10 marks)**

b) Ten nozzles each 25mm in diameter, all inclinced at 45^0 with the horizontal are used in an ornamental fountain. The jet issuing from the nozzle falls into a basin at a point 1.5m vertically beneath the nozzle and 4.5 horizontaally from it. The velocity co-efficient of nozzle is 0.97. determine

i) Pressure head at the nozzle and, **(8 marks)**

ii) Total discharge from the nozzles. **(2 marks)**

QUESTION 4

An oil of viscosity of 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60mm diameter. If the pressure drop in 100m length of the pipe is $1800kN/M^2$, determine

a) The rate of flow of oil
b) The centre-line velocity
c) The total frictional drag over 100m length
d) The power required to maintain the flow
e) The velocity gradient and shear stress at 8mm from wall. **(20 marks)**

QUESTION 5

a) Discuss momentum thickness and its derivation in boundary layer theory. **(8 marks)**

b) A pump delivers water from a tank A (water surface elevation = 110m) to tank B (water surface elevation = 170m). The suction pipe is 4.5m long (f = 0.024) and 35cm in diameter. The delivery pipe is 950m long (f = 0.022) and 25cm in diameter. The head discharge relationship for the pump is given by $H_p = (90 – 8000Q^2)$, where H_p is in metres and Q in m^3/s, calculate:

i) The discharge in the pipeline

ii) The power delivered by the pump

(12 marks)

Reference diagram 5 (b)