JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF SPATIAL PLANNING

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN WATER RESOURCE AND ENVIRONMENTAL MANAGEMENT

2ND YEAR 1ST SEMESTER 2017/2018 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: PWE 3211

COURSE TITLE: FLUID MECHANICS I

EXAM VENUE: LR 16 **STREAM: SPATIAL PLANNING**

DATE: 20/12/2017 **EXAM SESSION: 9.00 – 11.00 AM**

TIME: 2 HOURS

Instructions:

1. **Answer question 1 (compulsory) and ANY other 2 questions.**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

SECTION A [30 MARKS]

Answer ALL questions from this Section.

QUESTION 1

a) Using dimension analysis approach, find out if the equation $V^2 = u^2 + 2aS^2$ is dimensionally correct (*where V=final velocity; u=initial velocity; a=acceleration; S = distance*) **(6 Marks)**

b) Distinguish between: (i) Fluid statics (ii) Kinetics of flow (iii) Dynamics of Flow **(6 Marks)**

c) Find the pressure head *(H)* of water corresponding to an intensity *(P)* of 280,000 N/m^2, if mass density of water is 10^3 kg/m^3 **(6 Marks)**

d) Using sketch diagrams, distinguish between turbulent and laminar flow of fluids **(6 Marks)**

e) Using well labeled diagrams, distinguish between a manometer measuring fluid condition under (i) positive pressure and (ii) negative pressure **(6 Marks)**

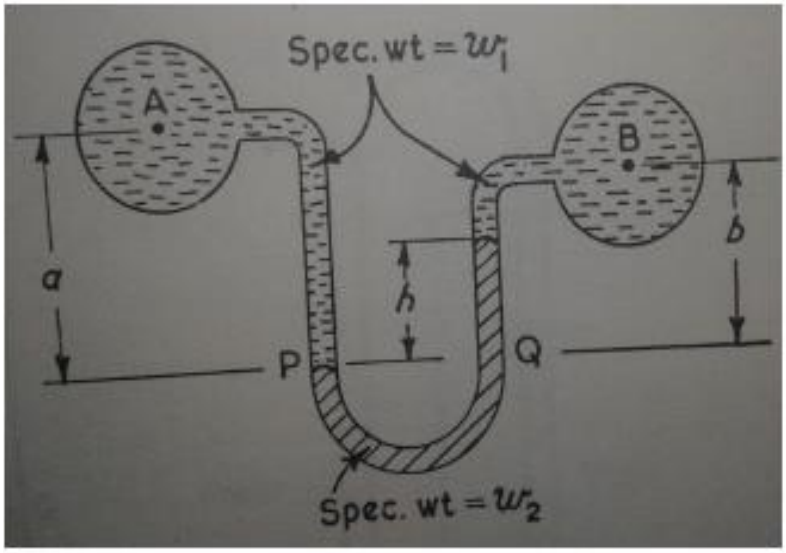
SECTION B [40 MARKS]

Answer ANY TWO questions from this Section.

QUESTION 2

a) Derive a mathematical expression distinguishing between the pressure exerted over solid surfaces and the pressure exerted on liquids **(6 Marks)**

(b) A U-Tube Manometer below has two liquids as shown:



Calculate the difference in pressure if *a*=1.7m, *b*=0.95m and *h*=0.8m. Take the liquid at A and B to be water (w_i= *9,81 x* 103N/m^3) and specific weight of Mercury is 13.6 times that of water. **(14 Marks)**

QUESTION 3

Pressure intensity of a plane surface immersed in water at depth x is given as ρgx. Prove that total pressure is given as $wA\bar{x}$ (where $w=\rho g$) and that this pressure is similar for (i) a horizontally immersed plane surface, (ii) a vertically immersed plane surface and (iii) an inclined plane surface **(20 Marks)**

QUESTION 4

a) A rectangular plate *2m x 3m* is immersed in water in such a way that its greatest and least depths are 6m and 4m respectively from the water surface. Calculate the total pressure on the plate

(8 Marks)

b) Using a sketch diagram of a curved surface immersed in water, generate mathematical expressions for (i) total pressure on curved surfaces and (ii) angle of inclination of the resultant pressure **(12 Marks)**

QUESTION 5

a) With the aid of a sketch diagram of a fluid element in a control volume, prove that mass flow rate is given by $\dot{m} = \rho AV$ **(6 Marks)**

b) In reference to a control volume of pipe flow, derive Bernoulli's equation from the principle of conservation of energy **(14 Marks)**