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

SEMESTER 2016/2017 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: PWE 3211

COURSE TITLE: FLUID MECHANICS I

EXAM VENUE: **STREAM: SPATIAL PLANNING**

DATE: **EXAM SESSION:**

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.**

Q1a) Distinguish between: (i) Fluid statics (ii) Kinetics of flow (iii) Dynamics of Flow **(6 Mks)**

b) 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 Mks)**

c) Using basic mathematical expressions, define the following:

(i) Mean Velocity (**2 Mks)**

(ii) Discharge **(2 Mks)**

(iii) Mass Flow rate **(2 Mks)**

d) By defining the terms of expression, identify three forms of energy heads from the following Bernoulli's expression of control volume, for pipe flow **(6 Mks)**

$$\frac{p_1}{\rho g} + \frac{u_1^2}{2g} + z_1 = \frac{p_2}{\rho g} + \frac{u_2^2}{2g} + z_2$$

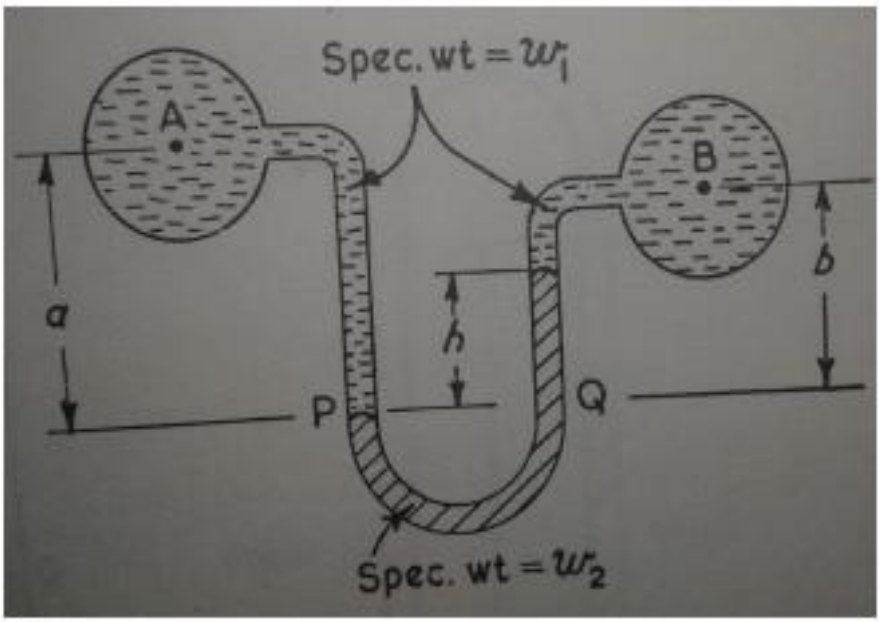
e) With the aid of a sketch diagram of a fluid element in a control volume, prove that mass flow rate is given by $\dot{m} = \rho AV$ **(6 Mks)**

Q2 (a) Using well labeled diagrams, distinguish between a manometer measuring fluid condition under

(i) positive pressure and **(3 Mks)**

(ii) negative pressure **(3 Mks)**

(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 Mks)**

Q3 a) Derive a mathematical expression distinguishing between the pressure exerted over solid surfaces and the pressure exerted on liquids **(8 Mks)**

(b) Using a sketch diagram of a curved surface immersed in water, generate mathematical expressions for

(i) total pressure on curved surfaces and **(6 Mks)**

(ii) angle of inclination of the resultant **(6 Mks)**

Q4) Pressure intensity of a plane surface immersed in water at depth x is given as ρgx. Prove that total pressure is given as wAẍ (where $w=\rho g$) and that this pressure is similar for

(i) a horizontally immersed plane surface **(8 Mks)**

(ii) a vertically immersed plane surface and **(6 Mks)**

(iii) an inclined plane surface **(6 Mks)**

Q5 In reference to a control volume of pipe flow, derive Bernoulli's (energy) equation from the first principle of conservation of energy **(20 Mks)**