



**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**

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**COURSE CODE: PWE 3211**

**COURSE TITLE: FLUID MECHANICS I**

**EXAM VENUE:**

**STREAM: SPATIAL PLANNING**

**DATE:**

**EXAM SESSION:**

**TIME: 2 HOURS**

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**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  $V^2 = u^2 + 2aS$  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)**

$$\frac{P_1}{\rho g} + \frac{u_1^2}{2g} + z_1 = \frac{P_2}{\rho g} + \frac{u_2^2}{2g} + z_2$$

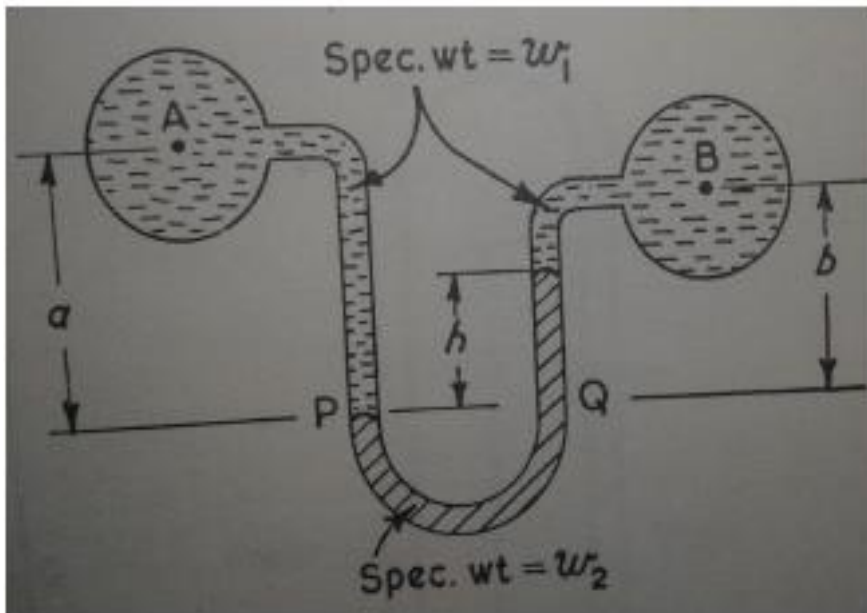
e) With the aid of a sketch diagram of a fluid element in a control volume, prove that mass flow rate is given by  $\dot{m} = \rho AV$  **(6 Mks)**

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  $a=1.7\text{m}$ ,  $b=0.95\text{m}$  and  $h=0.8\text{m}$ . Take the liquid at A and B to be water ( $w_1= 9,81 \times 10^3\text{N/m}^3$ ) 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  $\rho gx$ . 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 **(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)**