



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY  
SCHOOL OF SPATIAL PLANNING AND NATURAL RESOURCE MANAGEMENT  
UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE IN  
WATER RESOURCES AND ENVIRONMENTAL MANAGEMENT  
1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER 2013/2014 ACADEMIC YEAR  
REGULAR**

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**COURSE CODE: PWE 3211**

**COURSE TITLE: FLUID MECHANICS**

**EXAM VENUE: LR 6**

**STREAM: Water Sciences)**

**DATE: 22/04/14**

**EXAM SESSION: 2.00 – 4.00 PM**

**TIME: 2.00 HOURS**

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**Instructions:**

- 1. Answer Section A (Compulsory) and ANY other 2 questions in section B**
- 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 ONE: Answer Question One**

**(30 MARKS)**

**QUESTION ONE:**

- a) Distinguish the following terms as used in fluid mechanics; Newtonian Fluids and Non-Newtonian Fluids, hence or otherwise discuss the further classification under Non Newtonian fluids. (7 Marks)
- b) Outline some of the merits of manometers as instruments used to measure pressure gauge. (6 Marks)
- c) Define a streamline and state TWO properties associated with streamlines in fluid flows (6 Marks)
- d) State the law of conservation of mass hence show that for a steady flow, the continuity equation is given by (11 Marks)

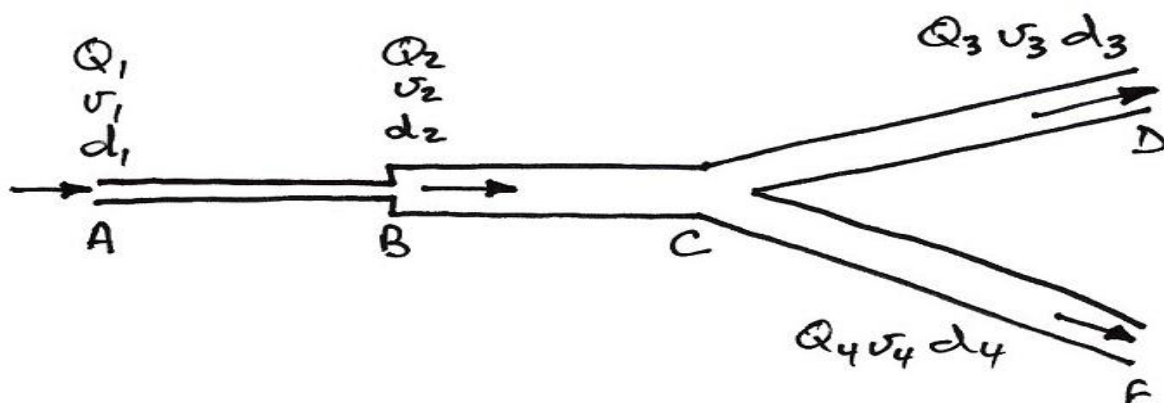
$$\rho \int u_1 \partial A_1 + \rho \int u_2 \partial A_2 = 0$$

**SECTION TWO: Answer any TWO Questions**

**(40 Marks)**

**QUESTION TWO:**

- a) State the limitations of manometers as instruments used to measure pressure gauge. (4 Marks)
- b) Density varies with temperature and pressure throughout in a compressible fluid domain. Using the equation of state for a perfect gas, derive the expression for pressure difference between two arbitrary points in a compressible fluid. (8 Marks)
- c) Water flows from point A to points D and E as shown. Some of the flow parameters are known, as shown in the table. Determine the unknown parameters.



Section	Diameter (mm)	Flow Rate ( $\text{m}^3 \text{s}^{-1}$ )	Velocity ( $\text{ms}^{-1}$ )
AB	300	?	?
BC	600	?	1.2
CD	?	$Q_3=2Q_4$	1.4
CE	150	$Q_4=0.5 Q_3$	?

(8 Marks)

### **QUESTION THREE:**

- Define the term moment and obtain the moment arm of fluid pressure force on an inclined surface defined by angle  $\theta$  with respect to x-axis. (9 Marks)
- State the FOUR assumptions considered in deriving Bernoulli's equation (4 Marks)
- Cross sectional area of pipe is  $A$  Mean velocity is  $u_m$ . In time  $t$ , a cylinder of fluid will pass point  $X$  with a volume  $A * u_m * t$ . If  $A = 1.4 * 10^{-3} \text{m}^2$  and discharge,  $Q$  is 24 l/s, calculate the mean velocity. (7 Marks)

### **QUESTION FOUR:**

- Differentiate the two approaches to analyzing the velocity field in fluid mechanics. (4 Marks)
- Fluids are categorized depending on their properties, explain any THREE of such properties. (6 Marks)
- Considering momentum conservation in fluid particles, Show that Euler's equation is given by  $\frac{D}{Dt}(\rho u) = (\rho g) - \nabla p$  in x-dimension of the coordinate system. (10 Marks)

### **QUESTION FIVE:**

- Explain the following terms as applied in flows in an open channel as opposed to the closed pipe: Depth, Wetted Perimeter, Surface Width, and Hydraulic Radius. (8 Marks)
- Viscosity as one of the properties of fluids varies with temperature change. Explain. (4 Marks)
- Discuss the FOUR forms of fluid flows as characterized by time and length of flow. (8 Marks)