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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

**SECOND YEAR FIRST SEMESTER
SUPPLEMENTARY EXAMINATIONS**

FOR THE DEGREE OF RENEWABLE ENERGY

COURSE CODE: REN 215

COURSE TITLE: BASIC FLUID MECHANICS

DATE: 5/02/2021

TIME: 11:00 - 1:00 PM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

Section A-Compulsory (30 marks)

QUESTION ONE

- a. Differentiate between Newtonian and non'-Newtonian fluids (4mks)
- b. Define the following terms:
 - I. Fluid mechanics (2mks)
 - II. Fluids (2mks)
- c. State what happens on the elements of solid and fluid particles when each is subjected on shear stress of the same magnitude (4mks)
- d. Using a well labelled diagram, explain the variation fluid velocities moving in a pipe (5mks)
- e. A mass m of 50kg acts on a piston of area A 100m². What is the intensity of pressure on water in contact with the underside of the piston? If the piston is in equilibrium (4mks)
- f. Find the head h of water corresponding to intensity of pressure p of 34000N/M². Take specific weight w of water as $\gamma = 9.81 \times 10^3 N/M^3$. (3mks)
- g. Define the following terms as used in fluid flow:
 - i. Steady Uniform flow (2mks)
 - ii. Steady non'-uniform flow (2mks)
 - iii. Unsteady'-uniform flow (2mks)

Section B -Answer any Two Questions (40marks)

Question Two

- a. Show from first principles that the theoretical rate of flow a rectangular notch is given by $Q = \frac{2}{3} B \sqrt{(2g)} H^{\frac{3}{2}}$ where B =width of the notch and H =height of the water level above the bottom of the notch. (5mks)
- b. Explain why this expression requires modification in practice. (3mks)
- c. The discharge over rectangular notch is to be 0.14m³/s when the water level is 23 cm above the sill. If the coefficient of discharge is 0.6. Calculate the width of notch required (6mks).
- d. With an aid of diagrams explain three types of equilibrium (6mks)

Question Three

- a. If pipe 1 diameter = 50mm, mean velocity 2m/s, pipe 2 diameter 40mm takes 30% of total discharge and pipe 3 diameter 60mm. What are the values of discharge and mean velocity in each pipe? (10mks)
- b. Proof that pressure acts equally in all directions. 10mks

Question Four

- a. Describe the arrangement of a venturi meter and explain its mode of action? (6mks)
- b. Derive an expression for the theoretical discharge through a horizontal venturi meter and show how it can be modified to obtain the actual discharge (5mks)
- c. A reservoir of water has the surface at 310m above the outlet nozzle of a pipe with diameter 15mm.

What is the

- i. Velocity (3mks)
- ii. The discharge out of the nozzle (3mks)
- iii. Mass flow rate. (Neglect all friction in the nozzle and the pipe).(3mks)

Question Five

- a. Explain with a diagram the action of an hydraulic jack. A Force P of 850N is applied to the smaller cylinder of an hydraulic jack. The area of smaller piston is 15cm² and the larger piston is 150cm². What load can be lifted on the larger piston
 - i. If the pistons are on the same level. **(5mks)**
 - ii. If the large piston is 0.75m below the smaller. **(7mks)**
Take the mass density of the liquid in the jack to be 1000kg/m³
- b. Describe with the use of sketches two methods of measuring atmospheric **(4mks)**
- c. The level of mercury in the barometer tube is 760mm above the level of mercury in the bowl. What is the atmospheric pressure in N/m²? The specific gravity of mercury is 13.6 and specific weight of water is 9810N/m². **(4mks)**