# MACHAKOS UNIVERSITY

**University Examinations for 2019/2020Academic Year**

**SCHOOL OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF BUILDING AND CIVIL ENGINEERING**

**SECOND YEAR SECOND SEMESTER EXAMINATION FOR**

**BACHELOR OF SCIENCE (CIVIL ENGINEERING)**

**ECV 207: FLUID MECHANICS II**

**DATE: 10/12/2020** **TIME: 8.30-10.30 AM**

**INSTRUCTIONS**

***Answer Question One and Any Other Two Questions***

**QUESTION ONE (30 MARKS)**

a) Define the following terms as used in fluid mechanics:

i. Dimensional Analysis (3 marks)

ii. Boundary layer (3 marks)

iii. Notch (3 marks)

iv. Co-efficient of discharge (3 marks)

b) State Four assumptions of Bernoulli's theorem (4 marks)

c) A jet of water is discharged through a nozzle with effective diameter $d$ of 75 mm and a velocity $v$ off 22.5m/s. Determine the power of the issuing jet. (11 marks)

d) A siphon has a uniform circular bore of 75 mm diameter and consists of a bent pipe with its crest 1.8 m above water level discharging into the atmosphere at a level 3.6 m below water level. Find the velocity of flow, the discharge and absolute pressure at crest level if the atmospheric pressure is equivalent to 10 m of water. Neglect losses due to friction.

(13 marks)

**QUESTION TWO (20 MARKS)**

a) State the Newton's second law of motion (3 marks)

b) A 800 mm main carries water under a head of 35 m with velocity of flow of 3.5 m/s. The main is fitted with a bend, which turns the axis through 70°. Determine the resultant force.

(12 marks)

**QUESTION THREE (20 MARKS)**

a) Derive a formula for the time of emptying a vertical cylindrical tank through an orifice in the bottom. (7 marks)

b) If such a tank is 2.5 m diameter and the orifice in the bottom is 65 mm diameter, find the initial height of water above the orifice in order that 3.5 $m^3$ of water will flow out in 400 seconds. Take $C_d$ for the orifice as 0.75. (8 marks)

**QUESTION FOUR (20 MARKS)**

a) Determine the conditions for maximum transmission of power through a pipe assuming loss of head by friction only. (5 marks)

b) A pipeline is 1820 m long and 0.370 m in diameter, and supply head at the inlet is 250 m. A nozzle with an effective diameter of 45 mm is fitted at the discharge end and has a coefficient of velocity 0.90. If $f$ for the pipe is 0.0055, calculate: the velocity of the jet, the discharge and power of the jet. (10 marks)

**QUESTION FIVE (20 MARKS)**

a) Differentiate between laminar and turbulent flows (3 marks)

b) A jet of water 24mm in diameter, moving with a velocity of 5.5 m/s strikes a flat plate at an angle of 30° to the normal of the plate. If the plate itself is moving at 1.25m/s and in the direction normal to the surface, calculate:

   i. Normal force exerted on the plate (4 marks)

   ii. Work done (4 marks)

   iii. Efficiency (4 marks)