



(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL
ENGINEERING

COURSE CODE: CSE 252/TEB 352

COURSE TITLE: FLUID MECHANICS II

DATE: FRIDAY 29TH APRIL 2022 TIME: 12.00 – 2.00 PM

INSTRUCTIONS:

1. This paper consists of **FIVE** questions.
2. Answer any **THREE** questions.
3. Candidates should not write anything on the question paper.
4. All symbols have their usual meaning unless otherwise stated.
5. Time allowed is **TWO (2)** hours

MMUST observes **ZERO** tolerance to examination cheating

This Paper Consists of 3 Printed Pages. Please Turn Over.

Question ONE (20 marks)

- a) There are different patterns of fluid flow, usually characterized by time and distance; explain (2 marks)
- b) State the following laws (3 marks)
- The law of conservation of matter
 - The law of conservation of energy
 - The law of conservation of momentum
- c) A pipe line 60cm diameter branches into two pipes of diameters 40cm and 30cm respectively. The flow rate of water in the main pipe is $1.5\text{m}^3/\text{s}$, while the flow velocity in 30cm branched pipe is 7.5m/s . Determine the flow velocity in 40cm branched pipe (4 marks)
- d) Show that the Darcy's loss in head due to friction is given by: (5 marks)

$$h_f \cong \frac{flQ^2}{3d^5}$$

- e) Show that the discharge over a rectangular weir is given by: (6 marks)

$$Q = \frac{2}{3} C_d * L \sqrt{2g} [H^{3/2}]$$

Question TWO (20 marks)

- a) A pipe of diameter 300mm and length 3500m is used for transmission of power by water. The total head at inlet of the pipe is 500m. Find the maximum power available at the outlet of the pipe. Take f as 0.006 (5 marks)
- b) Show that for maximum discharge over a broad crested weir {see Figure Q2 (b)} the relation between the head upstream and downstream is given by: (5 marks)

$$h = \frac{2}{3} H$$

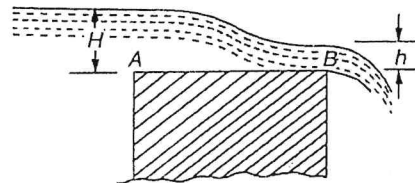


Figure Q2 (b)

- c) A syphon of diameter 200mm connects two reservoirs whose water surface level differs by 40m. The total length of the pipe is 8km. The pipe crosses a ridge. The summit of ridge is 8m above the level of water in upper reservoir {see Figure Q2 (c)}. Determine:
- The minimum depth of pipe below the summit (x) of the ridge if the absolute pressure head at the summit of the syphon is not to fall below 3m of water (8 marks)
 - The discharge (2 marks)
- Take f as 0.006, the atmospheric pressure head as 10.3 of water and the length of syphon from the upper reservoir to the summit as 0.5km.

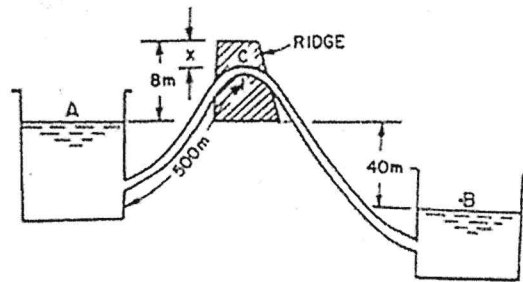


Figure Q2 (c)

Question THREE (20 marks)

- Two tanks of 8m and 3m diameters respectively are connected by 300m long pipe of diameter 250mm. The level of water in bigger tank is 10m higher than that of small diameter. Determine the time taken to flow 1800 litres of water. Take f as 0.0075 (5 marks)
- A rectangular orifice 0.9m wide and 1.2m deep is discharging water from a vessel. The top of the orifice is 0.6m below the water surface in the vessel. Calculate the discharge through the orifice if C_d is 0.6 and the percentage error if the orifice is treated as a small orifice (7 marks)
- A horizontal venturi-meter with inlet and throat diameters of 30cm and 15cm respectively is used to measure the flow of water. The reading of differential manometer connected to inlet and the throat is 20cm of mercury. Determine the rate of flow. Take C_d as 0.98 (8 marks)

Question FOUR (20 marks)

- Water flows through a pipe of 200mm diameter, 60m long with a velocity of 2.5m/s. Find the head loss due to friction by:
 - Darcy's formula ($f=0.005$)
 - Chezy's formula ($C=55$) (4 marks)
- A Cipolletti weir of crest length 60cm discharges water. The head of water over the weir is 360cm. Find the discharge (considering velocity of approach) over the weir if the channel is 80cm wide and 50cm deep. Take C_d as 0.60 (6 marks)
- Show that the discharge in a orifice is given by: (10 marks)

$$Q = c_d A_1 \sqrt{\frac{2gh}{k^2 - 1}}$$

Question FIVE (20 marks)

- A circular pipe of 250mm diameter carries an oil of specific gravity 0.8 at the rate of 120 litres per second and under pressure of 2kPa. Calculate the total energy in metres at a point which is 3m above the datum line (4 marks)
- An orifice meter with orifice diameter 100mm is inserted in a pipe of 200mm diameter. The pressure gauges fitted upstream and downstream of the orifice meter gives readings of 19.62N/cm² and 9.81N/cm² respectively. Find the discharge of water through the pipe. Take C_d as 0.6 (7 marks)
- An old water supply distribution pipe of 250mm diameter is to be replaced by two parallel pipes of equal diameter having equal lengths and identical values of coefficient of friction. Find the diameter of the new pipes (9 marks)