

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: DTC 1053
COURSE	: FLUID MECHANICS
SEMESTER/SESSION	: 1 - 2023/2024
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **5** questions. Answer ALL questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 5 PRINTED PAGES INCLUDING COVER PAGE

FLUID MECHANICS (DTC 1053)

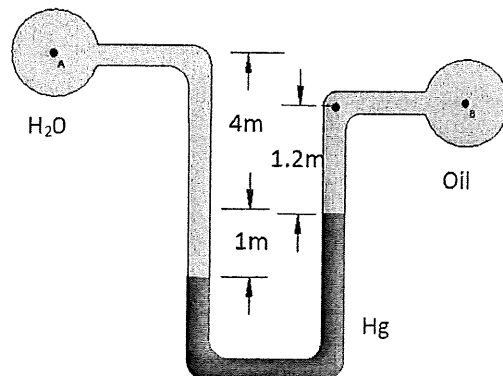
QUESTION 1

- a) Define Fluid Dynamics (1 marks)
- b) Describe one (1) differences between Fluid Mechanics and Solid Mechanics (2 marks)
- c) A liquid having specific gravity of 0.75 is filled in a vessel, produces its;
- i. Density (2 marks)
 - ii. Specific volume (2 marks)
 - iii. Specific weight (3 marks)

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QUESTION 2

- a) Define pressure and its unit in SI. (2 marks)
- b) Describe absolute pressure. (3 marks)
- c) A box with single sided glass wall (15 cm x 25 cm) fell in a lake near Boston. According to the rescuer, the approximate depth of the lake is around 120 m. ($Density = 1230 \text{ kg/m}^3$)
- Carry out the force exerted on the glass wall where the lake is a salt lake. (5 marks)
 - Relates your answer on (i) for three (3) type of bus which total weight approximately 3 tonnes. (3 marks)
 - Explain your answer in (ii) which pressure is much higher. (2 marks)
- d) Two pipes A and B contain water and air above in pipe A with 78.5 kPa pressure of air and oil of specific gravity 0.8 in pipe B respectively. The manometric liquid is mercury. Take $P_{atm} = 101.325 \text{ kPa}$.



Carry out the pressure calculation in pipe B (absolute)

(12 marks)

QUESTION 3

- a) Explain the relationship between Bernoulli's principle and pressure. (3 marks)
- b) A contracting and expanding pipe having a fluid flowing with density $\rho = 1360 \text{ kgm}^{-3}$ steadily through it. The section diameters are $d_1 = 0.75 \text{ m}$ and $d_2 = 0.55 \text{ m}$. The gage pressure at 1 is $P_1 = 120 \text{ kPa}$. The velocity at 1 is $v_1 = 3 \text{ m/s}$. The pipe is locating 15 cm from the ground at inlet and addition 1m from the ground for the outlet.
- Illustrate the pipe diagram (*including the data given*) (4 marks)
 - Predicts the velocity (v_2) and (5 marks)
 - Carry out the gage pressure at the outlet (P_2) (5 marks)
- c) A horizontal venturi meter with inlet diameter 30 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 21.5 Pa and the vacuum pressure at the throat is 3.05 Pa. Produces the discharge of water through venturi meter having $C_d = 0.95$. (10 marks)

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QUESTION 4

- a) Discuss the difference between laminar and turbulent flow (3 marks)
- b) Bitumen VG 20 at 20°C ($\rho = 1300 \text{ kg/m}^3$ and $\mu = 160 \text{ kg/m} \cdot \text{s}$) is flowing steadily through a 15cm diameter 70m long pipe. The pressure at the pipe inlet and outlet are measured to be 745 and 97 kPa, respectively. Carry out the flow rate of oil through the pipe assuming the pipe is
- Horizontal (5 marks)
 - Inclined 15° upward (5 marks)
 - Inclined 15° downward (5 marks)

QUESTION 5

- a) State two (2) simple flow rate and velocity measurement equipments. (3 marks)
- b) Water at 15°C ($\rho = 999 \text{ kg/m}^3$, $\mu = 1.138 \text{ kg/ms}$ and $f = 0.025$) is flowing steadily in a 5 cm diameter, 25 m long horizontal pipe made of stainless steel at a rate of 0.34 m³/min. Carry out the
- Pressure drop (5 marks)
 - Head loss (5 marks)
- c) Solve for minimum flow rate and maximum flow rate covered by the range of 0.3 ft to 2.0 ft for the head over a v notch weir that is fully contracted (5 marks)

-----End of question-----

