



MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 214: FLUID MECHANICS I

DATE: 20TH JANUARY, 2025

TIME: 11.00 AM – 1.00 PM

INSTRUCTIONS:

Answer question **ONE (Compulsory)** and **any other TWO** questions
All symbols have their usual meaning

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the following terms as used in fluid mechanics
 - i. Manometer (2 marks)
 - ii. Laminar flow (2 marks)
 - iii. Viscosity (2 marks)
 - iv. Centre of pressure (2 marks)
- b) A body requires a force of 140N to accelerate it at a rate of 0.25m/s^2 . Determine the mass of the body in Kilograms. (2 marks)
- c) With aid of simple sketches, explain what understand by unstable equilibrium condition. (6 marks)
- d) Find capillary rise in the tube (Figure Q1D) for a mercury-air-glass interface with $\theta = 132^\circ$, if the tube diameter is 1.5 mm. The surface tension at prevailing temperature is 0.0739 g/cm . (7 marks)

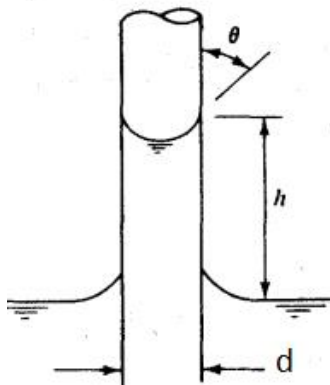


Figure Q1D

- e) A diver descends from the surface of the sea to a depth of 50 m. Determine the pressure under which the diver would be working above that at the surface, assuming

that the density of seawater is 1023 kg m^{-3} and remains constant.
(7 marks)

QUESTION 2 (20 MARKS)

- a) Explain how inclination of a manometer leg makes it sensitive. (5 marks)
- b) A U-tube is used to measure the pressure difference between two points A and B in a pipeline conveying water of density 1050 kg m^{-3} . The density of manometric liquid Q is $13.6 \times 10^{-3} \text{ kg m}^{-3}$, and point B is 0.75 m higher than point A. Calculate the pressure difference when $h = 1 \text{ m}$. (15 marks)

QUESTION 3 (20 MARKS)

Define centre of gravity and describe how the stability of a floating body depends upon the position of the Metacentre and the centre of gravity.

QUESTION 4 (20 MARKS)

A rectangular pontoon has a width of 7.5 m , a length of 13.5 m , and draught of 1.5 m in fresh water of density 1050 kg/m^3 . Calculate:

- a) Weight of the pontoon (6 marks)
- b) Its draught in sea water of density 1125 kg/m^3 (7 marks)
- c) The load that can be supported by the pontoon in fresh water if the maximum draught permissible is 2 m . (7 marks)

QUESTION 5 (20 MARKS)

A sluice gate (Figure Q5) is in the form of a circular arc of radius 6 m (Figure 23). Calculate the magnitude and direction of the resultant force on the gate, and the location with respect to O of a point on its line of action.

