(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

(Main Campus)

UNIVERSITY EXAMINATIONS

2023/2024 ACADEMIC YEAR

EXAMINATION

SECOND YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN DISASTER PREPAREDNESS & ENVIRONMENTAL TECHNOLOGY

COURSE CODE: **DPE 202**

COURSE TITLE: **FLUID MECHANICS**

DATE: 11/12/2023 **TIME: 12-2PM**

Instructions to Candidates

This paper contains FOUR (4) questions
Question **one is compulsory** {**total =30 Marks**}
Attempt **any other two** (2) {total = **40 Marks**} from the remaining questions
Be brief and to the point

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over ⟶

SECTION 1: COMPULSORY {30 MARKS}

Question ONE

a) With an aid of schematic, describe the development of velocity boundary layer in a pipe [5 Marks]

b) Briefly describe the relationship between Euler's and Bernoulli's Equations of motion [6 Marks]

c) Differentiate between Steady and unsteady flow [4 Marks]

d) With an aid of a diagram describe how Lamina flow changes into Turbulent flow [5 Marks]

e) Spherical buoy has a diameter of 1.5 m, weighs 8.50 kN, and is anchored to the sea floor with a cable as shown. The buoy normally floats on the surface, at other times the water depth increases so that the buoy is completely immersed as shown. What is the tension in the cable? [3 Marks]

f) Briefly discuss open channel flow [7 Marks]

SECTION II: ATTEMPT ANY OTHER TWO (2) QUESTIONS [40 MARKS]

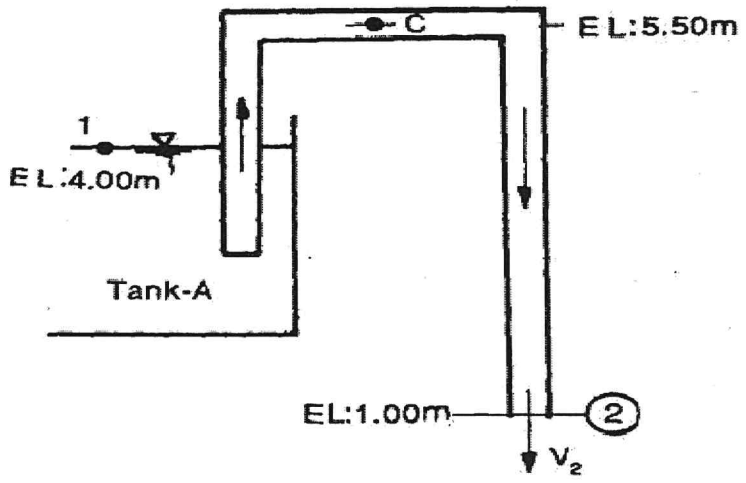
Question TWO

a) A siphon consisting of a pipe of 15 cm diameter is used to empty kerosene oil (RD = 0.80) from a tank A. The siphon discharges to the atmosphere at an elevation of 1.00 m. The oil surface in the tank is at an elevation of 4.00 m. The centrelines of the siphon pipe at its highest point C is at an elevation of 5.50 m. Estimate:

(i) the discharge in the pipe [5 Marks]

(ii) pressure at point C [5 Marks]

The losses in the pipe can be assumed to be 0.5 m up to the summit and 1.2 m from the summit to the outlet



b) Oil at 20°C (r 888 kg/m3 and m 0.800 kg/m · s) is flowing steadily through a 5-cm-diameter 40-m-long pipe (Fig. 8–17). The pressure at the pipe inlet and outlet are measured to be 745 and 97 kPa, respectively. Determine the flow rate of oil through the pipe assuming the pipe is:

i. Horizontal [3 Marks]

ii. Inclined 15° upward [2 Marka]

iii. Inclined 15° downward [2 marks]

iv. Also verify that the flow through the pipe is laminar [3 Marks]

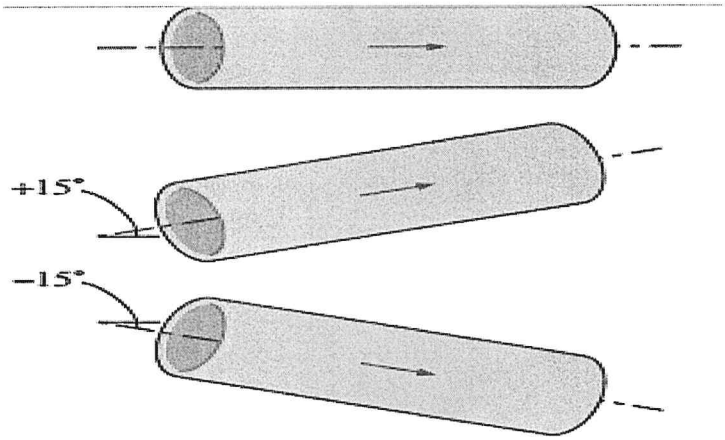


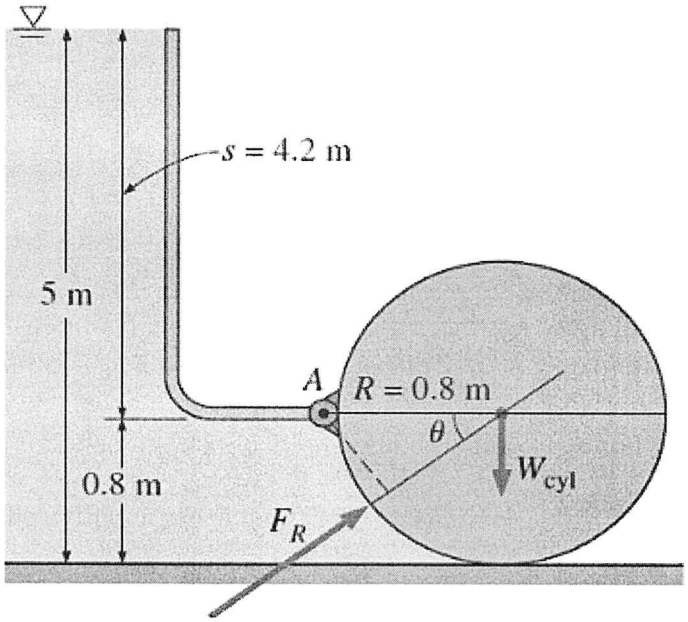
Figure 8-17

Question THREE

a) A long solid cylinder of radius 0.8 m hinged at point A is used as an automatic gate as shown in the figure below. When the water level reaches 5 m, the gate opens by turning about the hinge at point A. Determine:

i) The hydrostatic force acting on the cylinder and its line of action when the gate opens [3.5 Marks]

ii) The weight of the cylinder per m length of the cylinder [3.5 Marks]



b) Briefly discuss lamina flat plate boundary layer conditions [3 marks]

c) Air flows over a sharp-edged flat plate with L = 1 m, a width of 3 m and U_∞ = 2 m/s . For one side of the plate, find: $\delta(L)$, $C_f(L)$, $\tau_w(L)$, C_D, and F_D. [10 Marks]
Air: ρ = 1.23 kg/m^3 ν = 1.46 E-5 m^2/s

Question FOUR

a) Water at 40°F (r 62.42 lbm/ft^3 and μ= 1.038x10^{-3} lbm/ft s) is flowing through a 0.12-in- (0.010 ft) diameter 30-ft-long horizontal pipe steadily at an average velocity of 3.0 ft/s (Fig. 8–18). Determine:

i. The head loss [3 Marks]

ii. The pressure drop [3 Marks]

iii. The pumping power requirement to over- come this pressure drop [4 Marks]

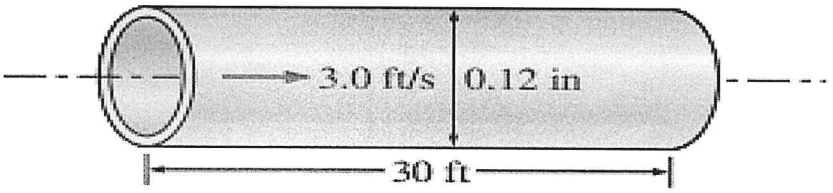
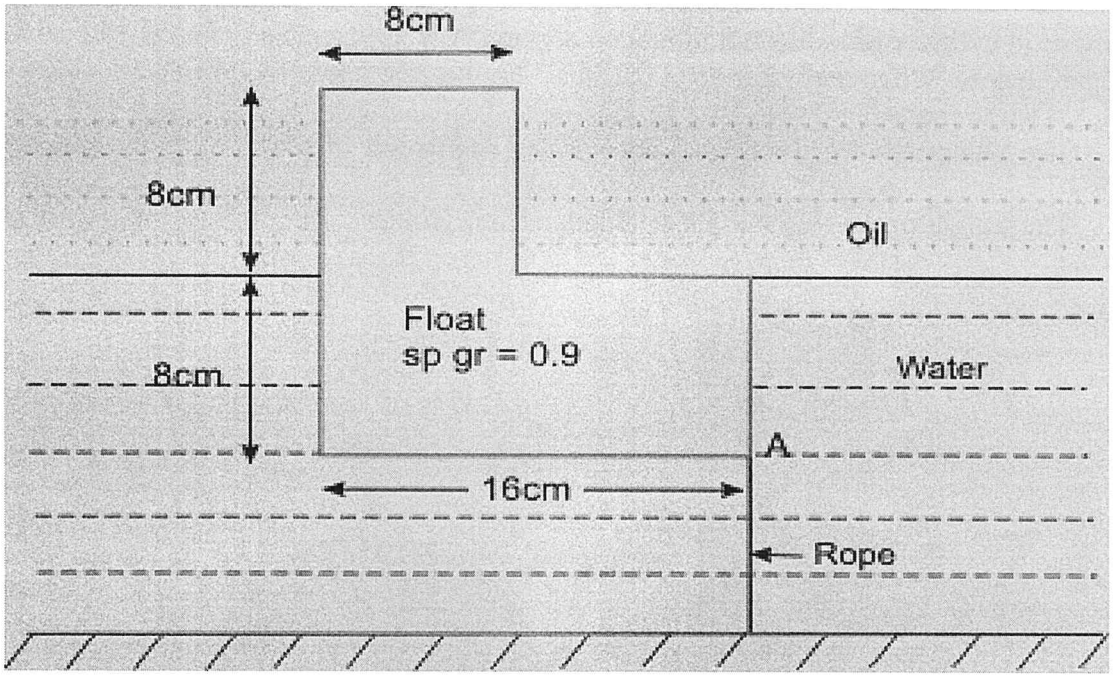


Figure 8-18

b) Use the diagram given below to determine the specific gravity of oil [10 Marks]



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