MACHAKOS UNIVERSITY

University Examination 2019/2020

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 202: FLUID MECHANICS I

DATE: 13/12/2019 **TIME: 2.00-4.00 PM**

INSTRUCTIONS

This paper contains **Five** questions attempt *question **One** and any other **Two***

QUESTION ONE (30 MARKS)

a) Define the following terms as used in fluid mechanics and give their dimensions

i. Fluid (2 marks)

ii. Units (2 marks)

iii. Viscosity (2 marks)

iv. Centre of pressure (2 marks)

b) A body requires a force of 120 N 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, show the three possible conditions of equilibrium. (3 marks)

d) Find capillary rise in the tube (Figure Q1D) for a mercury-air-glass interface with θ = 130°, if the tube diameter is 2 mm. The surface tension at prevailing temperature is 0.0739 g/cm (6 marks)

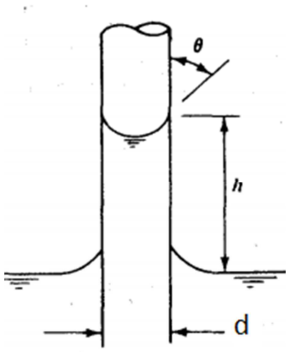

Figure Q1D

e) For the setup shown in Figure Q1E, what is the pressure PA if the specific gravity of oil is 0.83. (5 marks)

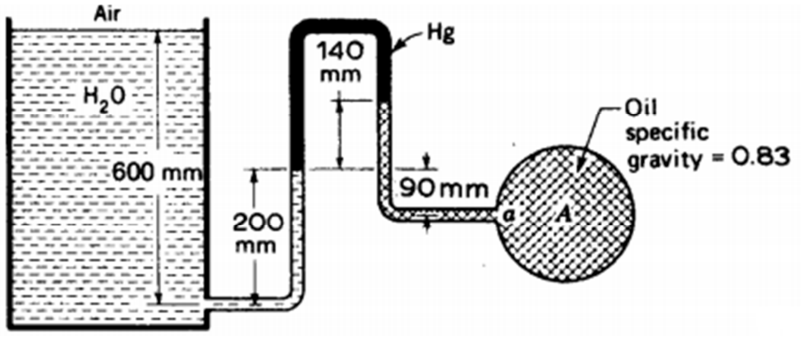

Figure Q1E

f) A diver descends from the surface of the sea to a depth of 40 m. Determine the pressure under which the diver would be working above that at the surface, assuming that the density of seawater is 1025 kg m^{-3} and remains constant. (8 marks)

QUESTION TWO (20 MARKS)

a) Explain how you can make a manometer sensitive (12 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 1000 kg m^{-3}. The density of manometric liquid Q is = 13.6 $\times 10^{-3}$ kg m^{-3}, and point B is 0.65 m higher than point A. Calculate the pressure difference when h = 0.95 m.

(9 marks)

QUESTION THREE (20 MARKS)

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

QUESTION FOUR (20 MARKS)

A rectangular pontoon has a width of 6.5 m, a length of 12.5 m, and draught of 1.0 in fresh water of density 1000 kg/m^3. Calculate:

a) Weight of the pontoon (5 marks)

b) Its draught in sea water of density 1025 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. (8 marks)

QUESTION FIVE (20 MARKS)

A closed tank (Figure Q5) rectangular in plan with vertical sides, is 1.8 m deep and contains water to a depth of 1.2 m. air is pumped into the space above the water until the air pressure is 35 kNm^2. If the length of the wall of the tank is 3 m, determine the resultant force on this wall and the height of the centre of pressure above the base.

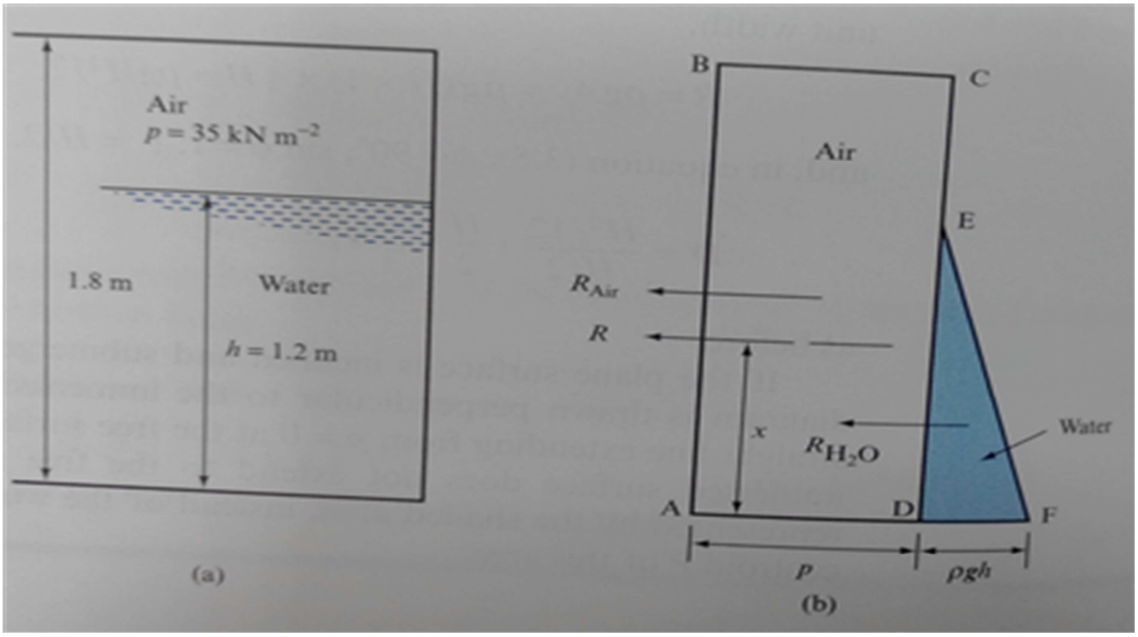

Figure Q5: Pressure Diagram