



FACULTY OF ENGINEERING AND ENVIRONMENT

DEPARTMENT OF METALLURGICAL ENGINEERING

DEPARTMENT OF MINING ENGINEERING

FLUID MECHANICS

EMI 2105

Final Examination Paper

June 2020

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Miss M. Kanganga

INSTRUCTIONS

1. This question paper consists of 5 questions
 - 1.1. Question 1 is compulsory
 - 1.2. Answer any other 3
2. Each question carries 25 marks
3. Answer each question on a new page and write as eligible as possible

Additional Requirements

1. calculator

Question 1

- 1.1 State Newton's law of viscosity. [1]
- 1.2 With the aid of diagrams, deduce the Newton's law of viscosity. [20]
- 1.3 State the differences between solids and liquids. [4]

Question 2

- 2.1 What do you understand by non-Newtonian fluids? [2]
- 2.2 Explain the following non-Newtonian fluids
- a) Pseudo plastics [2]
 - b) Dilatant substances [2]
 - c) Rheopectic materials [2]
 - d) Thixotropic substances [2]
 - e) Plastic materials [2]
 - f) Viscoelastic materials [2]
- 2.3 A reservoir of carbon tetrachloride (CCl_4) has a mass of 500kg and a volume of 0.315m^3 . Find the carbon tetrachloride's
- a) Weight [2]
 - b) Mass density [2]
 - c) Specific weight [2]
 - d) Specific gravity [2]
- 2.4 What are the causes of viscosity in a gas and a liquid? [3]

Question 3

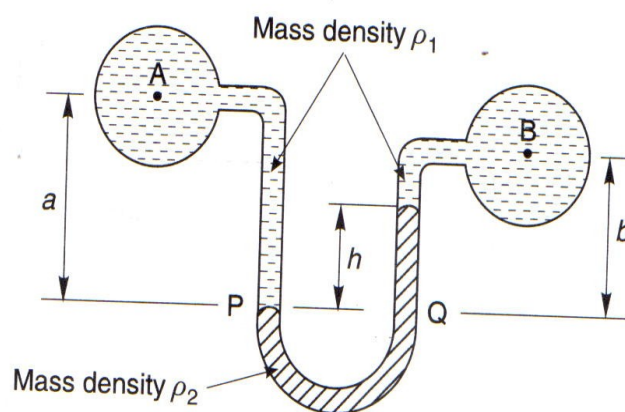


Figure 1

- 3.1 In Figure 1, the Fluid with density ρ_1 is water and the liquid in the U-tube is mercury. If the pressure difference between A and B is 35kN/m^2 , and $a = 1\text{m}$ and the height difference between A and B = 30cm what is the difference in level h . [10]

3.2 .a tank 3.5m long and 2.5 wide contains alcohol of relative density 0.82 to a depth of 3m.a 50mm diameter pipe leads from the bottom of the tank. What will be the reading on a gauge calibrated in Pa connected at a point

a).150mm above the bottom of the tank [10]

b) In the 50mm diameter pipe, 2m below the bottom of the tank [5]

Question 4

4.1 A fluid of constant density flows at the rate of 15litres/sec along a pipe AB of diameter 100mm. This pipe branches at B into two pipes BC and BD each of 25mm diameter and a third pipe BE of 50mm diameter. The flow rates are such that the flow through BC is three times the flow rate through BE and the velocity through BE is 4m/s. find the flow rate in the three branches BC, BD, and the velocities in pipes AB, BC, and BE [15]

4.2 A flat plate is struck normally by a jet of 50mm in diameter with a velocity of 18m/s.

- a) Calculate the force on the when it is stationary,
- b) The force on the plate when it moves in the direction as the jet with a velocity of 6m/s.
- c) The work done per second and the efficiency in the case of [10]

Question 5

5.1 Design a methodology for coming up with the size of pump and required to pump a certain amount of water from a mine. [25]