MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

…….. YEAR **SECOND** SEMESTER EXAMINATION FOR, BACHELOR OF SCIENCE IN ……………………..

EMT 207 – FLUID MECHANICS 1

DURATION: 2 HOURS

Instructions to candidates:

1. Answer question One and Any Other Two questions.

2. Mobile phones are not allowed in the examination room.

3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a) What is the difference between an ideal and real fluid?   (2marks)
b) If $5m^3$ of certain oil weighs 40KN calculate the specific weight, mass density and specific gravity of the soil.   (4marks)
c) What should be the diameter of a droplet of water, if the pressure inside is to be 0.0018 N/cm^2 greater than the outside. Given the value of surface tension of water in contact with air at $20^{o}c$ as 0.0075N/M
d) Determine the minimum size of glass tubing that can level, if the capillary rises in the tube is not to exceed 0.25cm. take surface tension of water in contact with air as 0.0075N/M   (5marks)
e) Calculate the capillary effect in mm in a glass tube 3mm in diameter when immersed in
    i)   Water
    ii)   Mercury

Both the liquids are $20^{o}c$ and the values of the surface tensions for water and mercury at $20^{o}c$ in contact with air are respectively 0.0736N/M and 0.5N/M. Contact angle for water = 0 and for mercury = 130° (5marks)

f) Find the diameter of a soap bubble when the inside pressure is $3N/M^2$ more than the outside pressure surface tension force is $0.01N/M^2$ (5marks)
g) If the density of the mud varies with depth from the surface h as
$$P = 1024 + 2h$$
Calculate the pressure at the depth of 3m   (5marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

a) State the Pascal law   (2marks)
b) Find the depth of a point below water surface in sea where pressure intensity is $1.006MN/M^2$, specific gravity of sea water = 1.025   (3marks)
c) The left leg of a V-tube mercury manometer is connect to a pipe-line conveying water, the level of mercury in the being 0.6m below the center of pipe-line 0.8. find the force exerted by the oil on the gate and the position of the center of pressure   (3marks)

QUESTION THREE (20 MARKS)

a) Explain briefly the following heads
    i.   Potential head

ii.   Velocity head

iii.   Total head   (6marks)

b) List the assumptions which are made while deriving Bernoullies equation   (5marks)

c) A pipe of 250m length tapers from 2.7m to 1.4m at the other end and has a slope of 10%. Higher end has the wide width and a flow of 2800litu/minute. If the pressure at lower end is 110kpa, neglecting the loss. Find the pressure at the higher end.   (5marks)

d) Fig 2 shows a stepped notch. Find the discharge through the notch if (d for all the sections is 0.61 and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and space above mercury in the right leg contains Benzene (specific gravity 0.88) to a height of 3m. find the pressure in the pipe   (5marks)

e) Define the terms gauge pressure, vacuum pressure and absolute pressure, indicate their relative postions on a chart   (3marks)

f) Describe with help of neat sketches two different types manometers   (4marks)

g) A triangular gate which has a base of 15m and an altitude of 2m lies in a vertical plane. The vertex of the gate is 1m below the surface of a tank which contains oil of specific gravity.

QUESTION FOUR (20 MARKS)

a) Describe the following types of flows

   i.   Steady flow and unsteady flow

   ii.   Uniform flow and non-uniform flow   (8marks)

b) Define the following terms

   i.   Wetted area

   ii.   Hydraulic radius   (2marks)

c) Find the discharge of water through the channel shown in fig 3. Take the value of Chezy's constant = 60 and slope of the bed as 1 in 950   (5marks)

d) A rectangular channel is to be dug in the rocky potion of a soil. Find its most economical cross-section if it is to convey $12m^3/s$ of water with an average velocity of 3m/s. take Chezy$^{/c}$ constant c =5D   (5marks)