



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

THE DEGREE IN BACHELOR OF SCIENCE IN MECHANICAL

ENGINEERING

EMG 2205 : FLUID MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

Do not write on the question paper.

Question ONE

a) Explain the following terms

- i. Capillary rise
- ii. Capillary depression

(4marks)

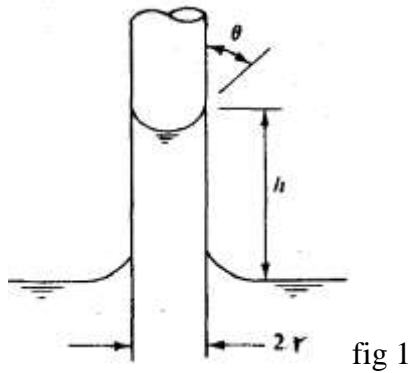
b) Derive the equation for the raise of water in a glass tube (6marks)

c) Find the capillary rise in the tube shown in figure.1

- i. For a mercury air glass interface with $\theta = 130^\circ$ if the radius is 1mm and the temperature is 20°C
- ii. For a water air glass interface with $\theta = 0$ if the radius is 1mm and the temperature is 20°C

Take density of mercury to be 13570kg/m^3 and water 1000kg/m^3 at 20°C surface tension

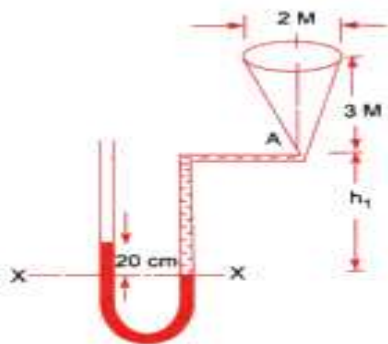
$\sigma_{\text{water}}=0.0728\text{N/m}$ $\sigma_{\text{mercury}}=0.514\text{N/m}$ (6marks)



- d) Find the surface tension in a soap bubble of 40mm diameter when the inside is 2.5N/m^2 above atmosphere pressure. (4marks)

Question TWO

- a) Explain the following terms
- i. Absolute pressure
 - ii. Gauge pressure
 - iii. Vacuum pressure (3marks)
- b) The figure below shows a conical vessel having its outlet at A which a U-tube manometer is connected. The reading of the manometer given in the figure shows when the vessel is empty. Find the reading of the manometer when the vessel is completely filled with water



Take sp gravity of mercury=13.6 (8marks)

- c) Explain the following terms:
- i. Potential head
 - ii. Pressure head
 - iii. Kinetic head (3 marks)

- d) A pipe 200m long slopes down at 1 in 100 and tapers from 600 mm diameter at the higher end to 300 mm diameter at the lower end, and carries 100 litres/sec of oil (sp gravity 0.8) if the pressure gauge at the higher end reads 60KN/m^2 . Calculate
- Velocities at the two ends
 - Pressure at the lower end.

Neglect all losses.

(6marks)

Question THREE

- Define the following terms
 - Orifice
 - Weir
 - Notch

(6 marks)
- Derive the expression for actual discharge over a triangular notch (9 marks)
- Find the discharge over a triangular notch of angle 60° when the head over the triangular notch is 0.2m. Assume $C_d=0.6$ (5 marks)

Question FOUR

- Define vena contracta (2 marks)
- Explain how to determine the co-efficient of velocity (6 marks)
- Show that

$$C_d = C_v \times C_c \quad \text{(3 marks)}$$

- Water discharged at the rate of 98.2 litres /seconds through a 120 mm diameter vertical sharp- edged orifice placed under a constant head of 10 metres. A point on the jet, measured from the vena-contracta of the jet has co-ordinates 4.5 metres horizontal and 0.54 metres vertical. Find
 - Co-efficient of velocity
 - Co-efficient of contraction
 - Co-efficient of discharge (9 marks)

Question FIVE

- a. Describe a pitot tube (2 marks)
- b. A pitot tube placed in the centre of a 300 mm pipe line has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.8 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm of water. Take the co-efficient of pitot tube as $C_v = 0.98$. (5 marks)
- c. Describe a venturimeter (4 marks)
- d. In a vertical pipe conveying oil of specific gravity 0.8, two pressure gauge have been installed at A and B where the diameter are 16 cm and 8 cm respectively. A is 2 metres above B. The pressure gauge reading have shown that the pressure at B is greater than at A by 0.981 N/cm^2 . Neglecting all losses
- i. Calculate the rate flow.
 - ii. If the gauges at A and B are replaced by tubes filled with the same liquid and connected to a U-tube containing mercury .Calculate the difference of level of mercury in the two limbs of the U-tube. (9 marks)