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 $\theta = 130^{\circ}C$ if the radius is 1mm and the temperature is $20^{\circ}C$

   ii.   For a water air glass interface with $\theta = 0$ if the radius is 1mm and the temperature is $20^{\circ}C$

   Take density of mercury to be $13570kg/m^3$ and water $1000kg/m^3$ at $20^{\circ}c$ surface tension

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

fig 1
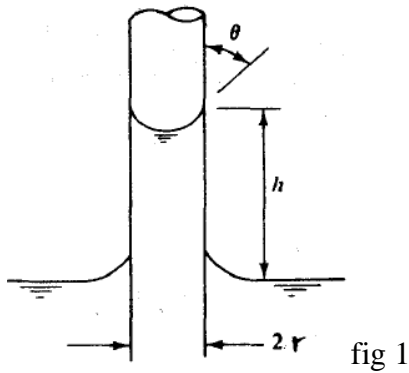
d) Find the surface tension in a soap bubble of 40mm diameter when the inside is $2.5N/m^2$ above atmosphere pressure. (4marks)

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
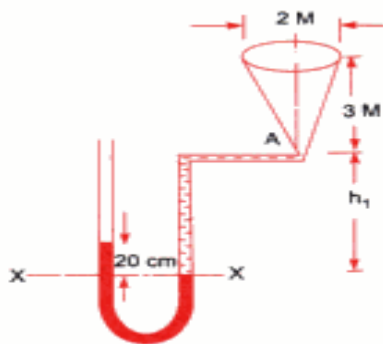
    Take sp gravity of mercury=13.6 (8marks)

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 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/m².Calculate

    i.   Velocities at the two ends

    ii.   Pressure at the lower end.

    Neglect all losses.   (6marks)

Question THREE

a) Define the following terms

    i.   Orifice

    ii.   Weir

    iii.   Notch   (6 marks)

b) Derive the expression for actual discharge over a triangular notch   (9 marks)

c) Find the discharge over a triangular notch of angle 60o when the head over the triangular notch is 02m.Assume C_d=0.6   (5 marks)

Question FOUR

a. Define vena contracta   (2 marks)

b. Explain how to determine the co-efficient of velocity   (6 marks)

c. Show that

$$C_d = C_V X C_C$$
                (3 marks)

d. 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

    i.   Co-effientient of velocity

    ii.   Co-efficient of contraction

    iii.   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)