TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IMMARINE ENGINEERING

EMR 2217 : THERMO FLUIDS II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: Pick Date May 2016

<u>**Instructions to Candidates**</u>
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 rigid vessel contains 1 kg of a mixture of saturated water and saturated steam at a pressure of 0.15 MPa. When the mixture is heated, the state passes through the critical point. Determine
      (a) The volume of the vessel
      (b) The mass of liquid and of vapour in the vessel initially
      (c) The temperature of the mixture when the pressure has risen to 3 MPa
      (d) The heat transfer required to produce the final state (c).

                                                        20 marks

Question TWO
  a) A circular opening in a vertical dam face (Fig 1) is closed by a gate mounted on trunnions
      on its horizontal centre line. The gate has a diameter of 4.2 m and its horizontal centre line is 5.0 m
      below the water level in the dam. Determine the magnitude of the pulling force required to be applied at
      a point 2.0 m above the centroid of the gate to just keep the
      gate closed against the hydrostatic thrust of the water.   12 marks

  b)

c) An open container has water to a depth of 2.5m (Fig2) and above this an oil of S = 0.85 for a depth of 1.2m. Find the intensity of pressure at the interface of two liquids and at the bottom of the tank 8marks
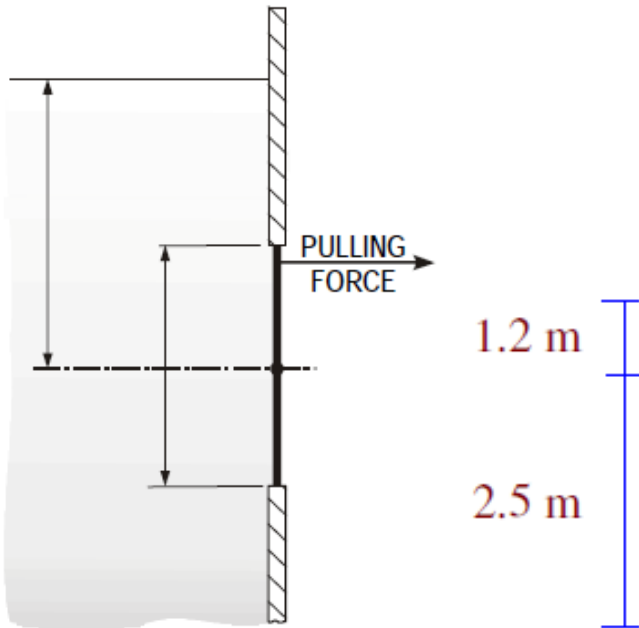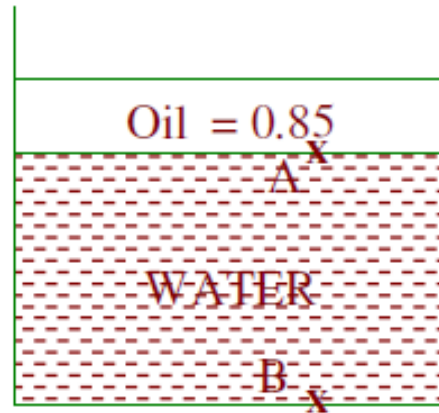

FIG 1

FIG 2

Question THREE

a) For the venturi meter and manometer installation (Fig 3) ,determine the volume rate of flow for the manometer reading.Δh. Data: D_1 =200mm; D_2 =150mm; Z_1 = 1m; Z_2 =1.3m;.Δh = 0.2m; ρ=1000kg/m^3 ; ρ_m =13600kg/m^3

10 marks

b) A conical tube of length 2 m is fixed vertically with its smaller end upwards. The velocity of flow at the smaller end is 5 m/s while at the lower end it is 2 m/s. The pressure head at the smaller end is 2.5 m/s of liquid. The loss of head in the tube is

$$0.35 \frac{[V_1 - V_2]^2}{2g}$$

Where V_1 is the velocity at the smaller end and V_2 is the velocity at the lower end respectively.

I.   Sketch the arrangement
II. Determine the pressure head at the lower end. Flow takes place in the downward direction.
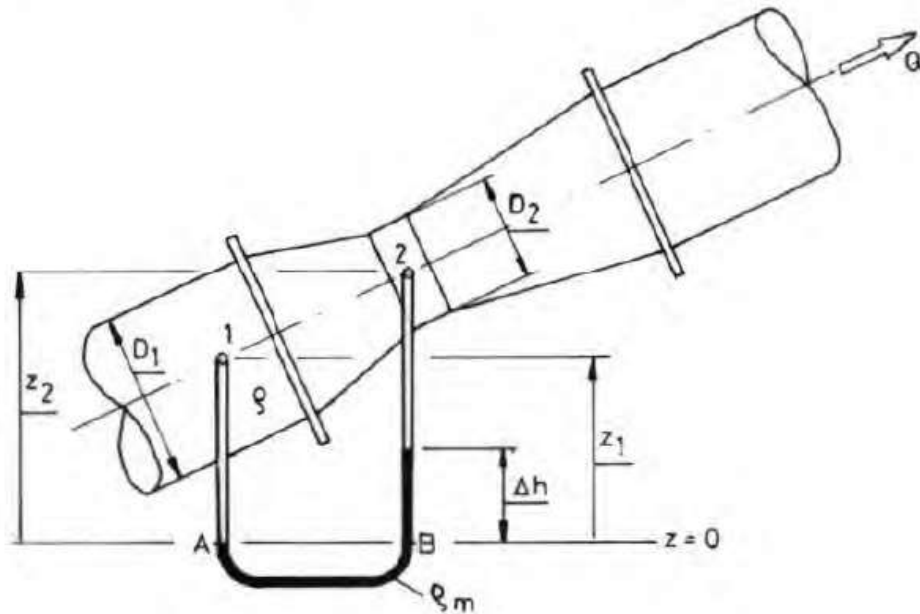
10 marks

FIG 3

Question FOUR

a) Define coefficient of performance (COP) of a refrigeration system.   2 marks

b) A refrigeration machine is required to produce i.e., at 0°C from water at 20°C.
The machine has a condenser temperature of 298 K while the evaporator temperature is 268 K. The relative efficiency of the machine is 50% and 6 kg of Freon-12 refrigerant is circulated through the system per minute. The refrigerant enters the compressor with a dryness fraction of 0.6. Specific heat of water is 4.187 kJ/kg K and the latent heat of ice is 335 kJ/kg. Calculate the amount of ice produced on 24 hours.

18 marks

Question FIVE

An air conditioning system is taking in outside air at 10 oC and 30% relative humidity at a steady rate of 45 m3 min-1 and is conditioning it to 25 oC and 60% relative humidity. The outdoor air is first heated to 22 oC in the heating section and then humidified by injection of hot steam in the humidifying section. Assume that the processes take place at 100 kPa pressure.
Sketch the arrangement and Determine:
a) The rate of heat supply in the heating section?
b) The mass flow rate of the steam required in the humidifying section?

20 marks