



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MARINE ENGINEERING

EMR 2217 : THERMO-FLUIDS II

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 Choose No questions. Attempt Choose instruction.

Do not write on the question paper.

Question ONE

- a) Water at 40°C is continuously sprayed into a pipeline carrying 5 tonnes of steam at 5 bar, 300°C per hour. At a section downstream where the pressure is 3 bar, the quality is to be 95%. Find the rate of water spray in kg/h.

12 marks

- b) A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?

8 marks

Question TWO

- a) A cylindrical barrier (Fig 1) holds water as shown. The contact between cylinder and wall is smooth. 10 marks
- b) 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. 10 marks

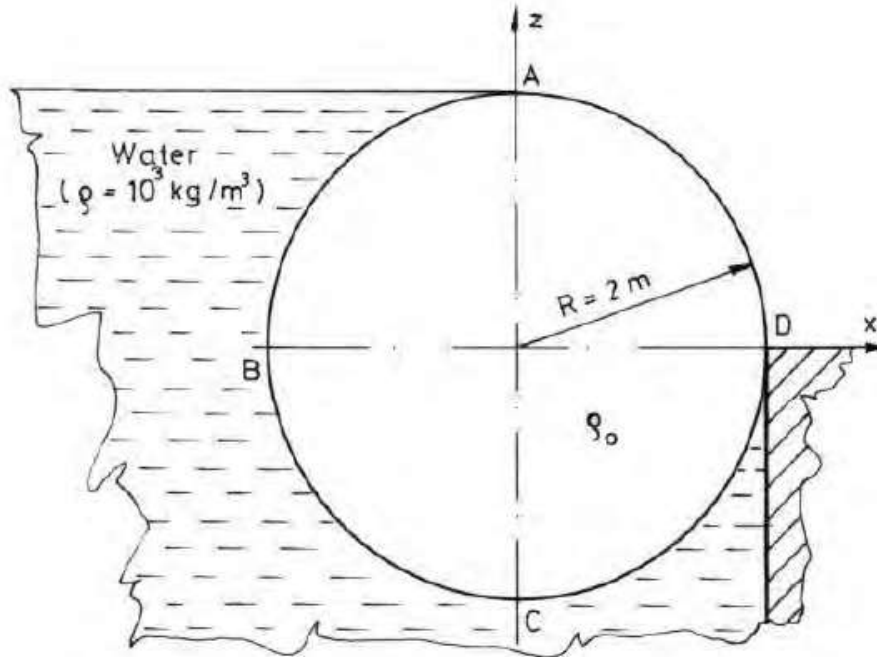


FIG 1

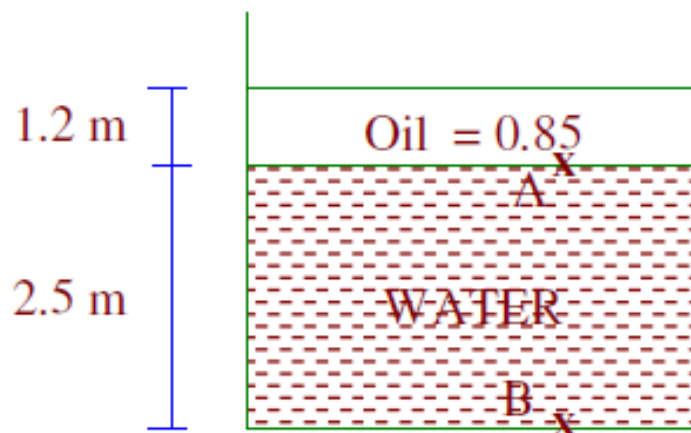


FIG 2

Question THREE

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:

- The rate of heat supply in the heating section?
- The mass flow rate of the steam required in the humidifying section?

20 marks

Question FOUR

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

- For the venturi meter and manometer installation (Fig 3), determine the volume rate of flow for the manometer reading, Δh . Data: $D_1 = 200\text{mm}$; $D_2 = 150\text{mm}$; $Z_1 = 1\text{m}$; $Z_2 = 1.3\text{m}$; $\Delta h = 0.2\text{m}$; $\rho = 1000\text{kg/m}^3$; $\rho_m = 13600\text{kg/m}^3$ 10 marks
- 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.

- Sketch the arrangement
- Determine the pressure head at the lower end. Flow takes place in the downward direction.

10 marks

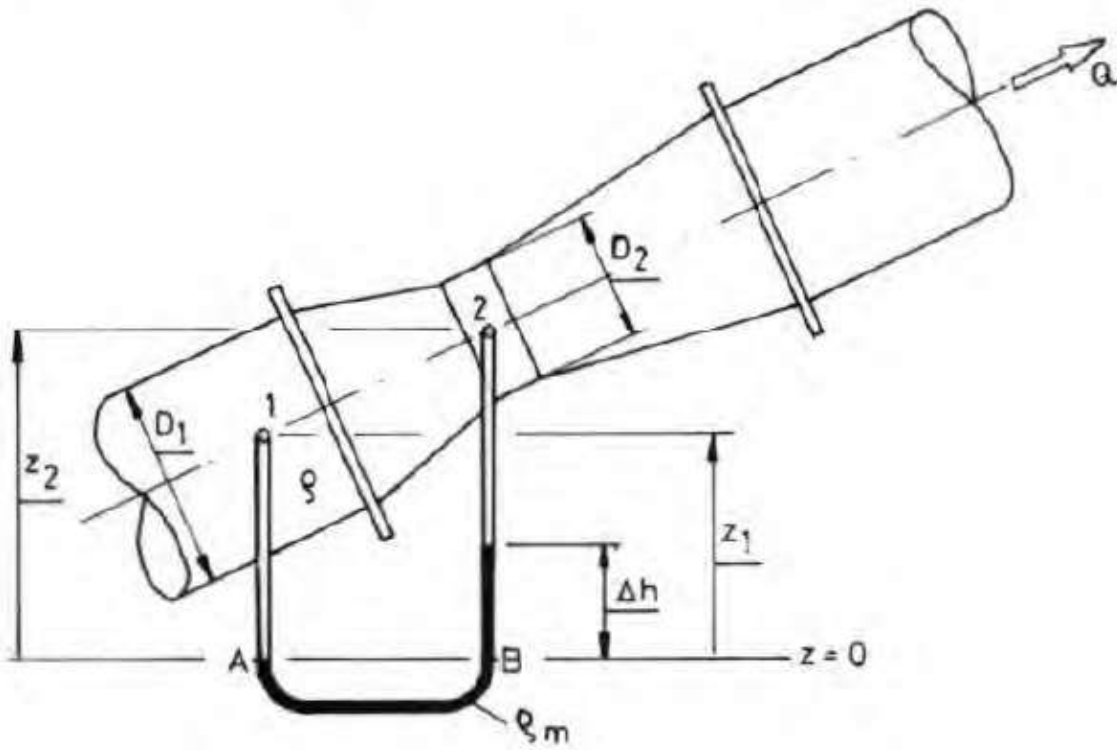


FIG 3