

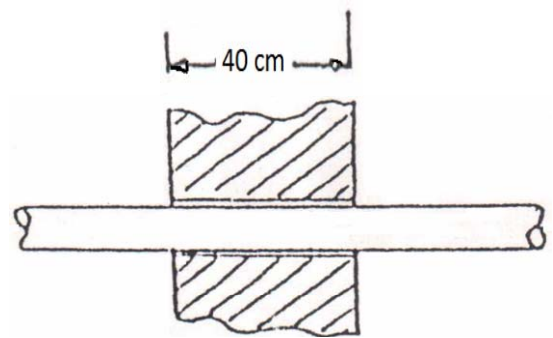
	Alexandria Higher Institute of Engineering & Technology (AIET)	
	Industrial Department	2 nd Year
	ME251	Fluid Mechanics
	Examiners:	Dr. Rola Afify and committee
		Final, Jan., 12, 2016
		Time: 3 hours

Answer the following questions:

Question one (12 marks)

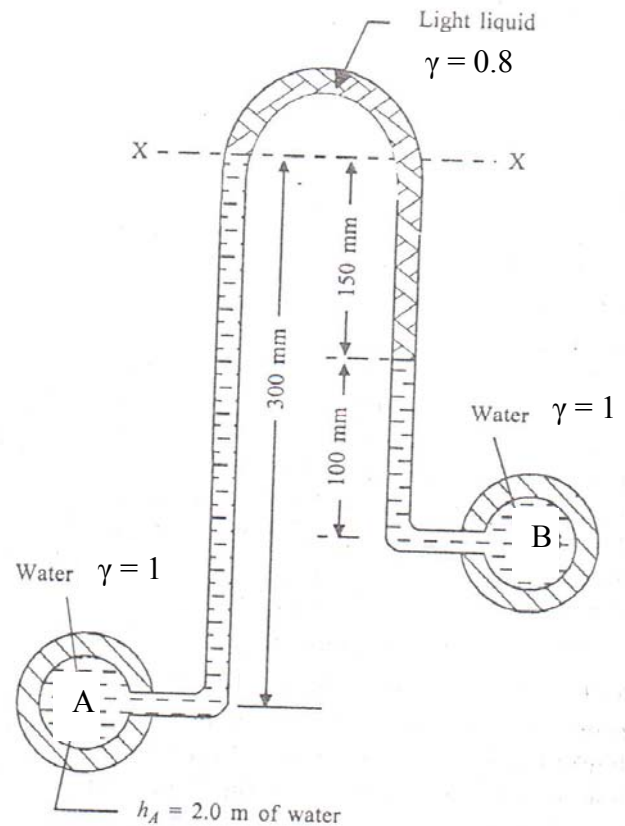
- a) The pressure of 1 m³ of a fluid is increased 10 to 20 bar at a constant temperature, calculate the final volume of the fluid in the following cases:-
- The fluid is an ideal gas.
 - The fluid is water ($k = 2 \times 10^9 \text{ N/m}^2$).
- Use the results to explain the main difference between liquids and gases.

- b) A shaft 6.00 cm in diameter is being pushed axially through a bearing sleeve 6.02 cm in diameter and 40 cm long. The clearance, assumed uniform, is filled with oil. Problems whose properties are $\nu = 0.003 \text{ m}^2/\text{s}$ and $\gamma = 0.88$. Estimate the force required to pull the shaft at a steady velocity of 0.4 m/s.



Question two (12 marks)

- a) The inverted differential manometer have an oil of specific gravity 0.8 connected to two different pipes carrying water under pressure. Determine the pressure in the pipe B. The pressure in pipe A is 2.0 meters of water
- b) A rectangular tank (3 m long, 2 m wide, and 2.5 m high) contains oil of specific gravity $\gamma = 0.9$. Calculate the magnitude, direction, and line of action of the pressure force on the following:
- The sides of the tank.
 - The tank's bottom.



Question three (12 marks)

- a) Compare between:-
- Ideal flow and Real flow.
 - Steady flow and unsteady flow.
 - Venturi meter and orifice meter.

- b) Two water tanks A and B are connected with a cast iron pipe ($\epsilon = 0.25$ mm) 15 cm diameter and 800 m long has a coefficient of friction ($f = 0.025$). Along the pipe, there are a fully opened gate valve ($k = 1.2$), three 45° bends (k for each = 0.8) and four 45° bends (k for each = 0.6). For sudden contraction $k = 0.5$ and enlargement $k = 1.0$.
- Find the difference in levels between water surfaces in two tanks, so that a discharge of 60 lit/s flows from tank A to tank B.
 - If the valve is partially closed to reduce the discharge to 60% of its initial value, keeping the same difference in levels, what will be the head lost in the valve.

Question Four (12 marks)

- Compare between Piston pump and Diaphragm pump.
- Explain how to avoid cavitation.
- A centrifugal pump has the following performance at rotating speed of 2900 rpm:

Q (lit/s)	0	5	10	15	20	25
hm (m)	70	74	73	65	53	40
η (%)	0	60	76	72	58	41

If this pump is used in a system where the difference between delivery and suction levels (h_{st}) is 50 m and losses in suction pipe is 5 m and in delivery pipe is 10 m, kinetic energy is 0.2 and the pump is placed 3 m above suction level, calculate:

- The head required from pump.
- The pump discharge.
- The shaft power consumed at pump operating point.
- The manometric suction head.

Question Five (12 marks)

- Draw a complete hydraulic circuit used to move a cylinder forward and backward with a controllable velocity. This circuit contains:-
 - Vented reservoir.
 - Hydraulic pump.
 - Electric motor.
 - Filter.
 - Check valve
 - Relief valve.
 - Directional control.
 - Flow control valve.
 - Cylinder.
- Write the functions of:-
 - Oil tank.
 - Valves.
 - Piping.