Department	Mechanical		Program	B.Tech		
Subject Name	Fluid Mechanics		Subject Code	MEC 303		
Semester	3rd	Credits	3	Teacher Incharge/Mentor		Prof. Adnan Qayoum
TA	K Sumanth/Ovais Gulzar Research Scholars		Mobile No.	9440270028	Email	sumanth365k@gmail.com/ ovais_23phd15@nitsri.net

Unit I

Text Book to be used:

1. Fundamentals of Fluid Mechanics by Munson 6th Edition, John Wiley 2010

Links to the Resources:

1. http://nptel.ac.in/courses/112105171/1
2. http://nptel.ac.in/courses/112105171/2
3. http://nptel.ac.in/courses/112105171/3

Lecture 1:

1.	Introduction	Page No 1-2
1.1	Characteristics of fluids	Page No 3-4
1.3	Analysis of fluid behavior	Page No10 -11
Lecture 2:		
1.5	Ideal Gas law	Page No. 11-12
1.6	Viscosity	Page No. 13-15
1.7	Compressibility of fluids	Page No. 20-21
1.7.3	Speed of sound	Page No. 22-23
1.10	A brief Look Back in History	Page No. 27-29
Lecture 3:		
2.1	Pressure at a point	Page No. 38-40
2.2	Basic equations for pressure field	Page No. 40-41
Lecture 4:		
2.3	Pressure Variation in a fluid at rest	Page No. 41-46
Lecture 5:		
2.4	Standard Atmosphere	Page No. 47-48
2.5	Measurement of Pressure	Page No. 48-50
Lecture 6:		
2.6	Manometer	Page No. 50-54
Lecture 7:		
2.7	Mechanical and Electronic Pressure Measuring Device	Page No. 55-56
Lecture 8:		
2.8	Hydrostatic force on a plane surface	Page No. 57-63
Lecture 9:		
2.9	Pressure Prism	Page No. 63-66
2.10	Hydrostatic force on a curved surface	Page No. 66-68
Lecture 10:		
2.11	Buoyancy, Flotation and stability	Page No. 68-72
Lecture 11:		
2.12	Pressure Variation in a fluid with Rigid Body Motion	Page No. 72-78

Tutorial Problems:

1. The basic elements of a hydraulic press are shown in Fig. 1. The plunger has an area of 1 in^2, and a force F_1, can be applied to the plunger through a lever mechanism having a mechanical advantage of 8 to 1. If the large piston has an area of 150 in^2 , what load F_2, can be raised by a force of 30 lb applied to the lever? Neglect the hydrostatic pressure variation.

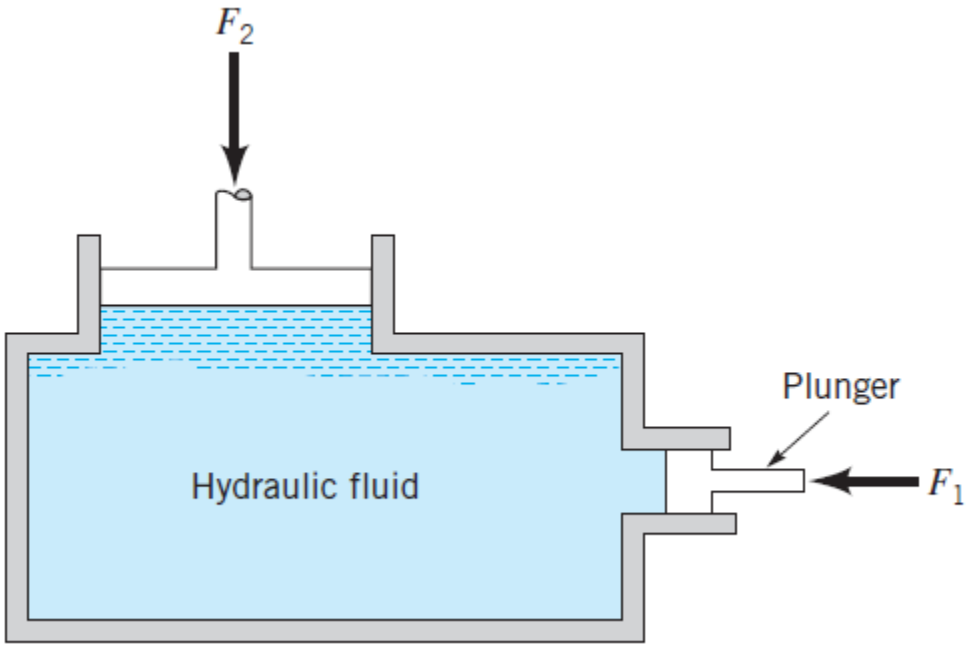

Fig. 1

2. A 0.3-m-diameter pipe is connected to a 0.02-m diameter pipe and both are rigidly held in place. Both pipes are horizontal with pistons at each end. If the space between the pistons is filled with water, what force will have to be applied to the larger piston to balance a force of 80 N applied to the smaller piston? Neglect friction.

3. A closed cylindrical tank filled with water has a hemispherical dome and is connected to an inverted piping system as shown in Fig. 2. The liquid in the top part of the piping system has a specific gravity of 0.8, and the remaining parts of the system are filled with water. If the pressure gage reading at A is 60 kPa, determine: (a) the pressure in pipe B, and (b) the pressure head, in millimeters of mercury, at the top of the dome (point C).

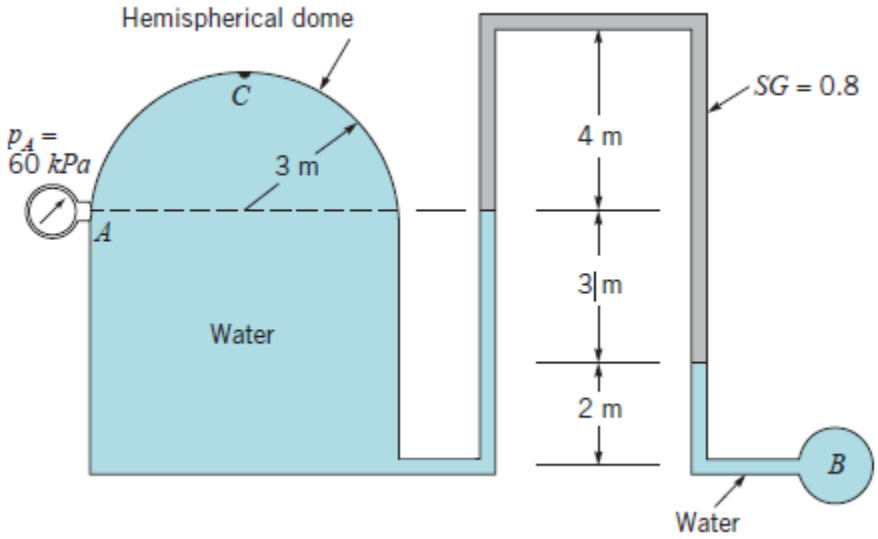

Fig. 2

4. The inverted U-tube manometer of Fig. 3 below contains oil (SG = 0.9) and water as shown. The pressure differential between pipes A and B, p_a - p_b is -5 kPa. Determine the differential reading, h.

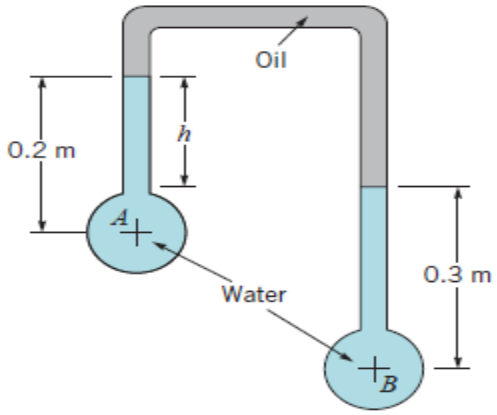

Fig. 3

5. A piston having a cross-sectional area of $0.07m^2$ is located in a cylinder containing water as shown in Fig.4. An open U-tube manometer is connected to the cylinder as shown. For h_1 60 mm and h = 100 mm, what is the value of the applied force, P, acting on the piston? The weight of the piston is negligible.

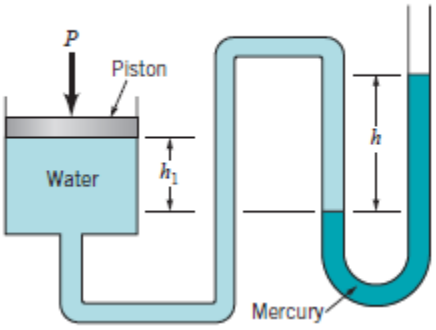

Fig.4

6. The cylindrical tank with hemispherical ends shown in Fig. 5 contains a volatile liquid and its vapor. The liquid density is and its vapor density is negligible. The pressure in the vapor is 120 kPa (abs), and the atmospheric pressure is 101 kPa (abs). Determine: (a) the gage pressure reading on the pressure gage; and (b) the height, h, of the mercury manometer.

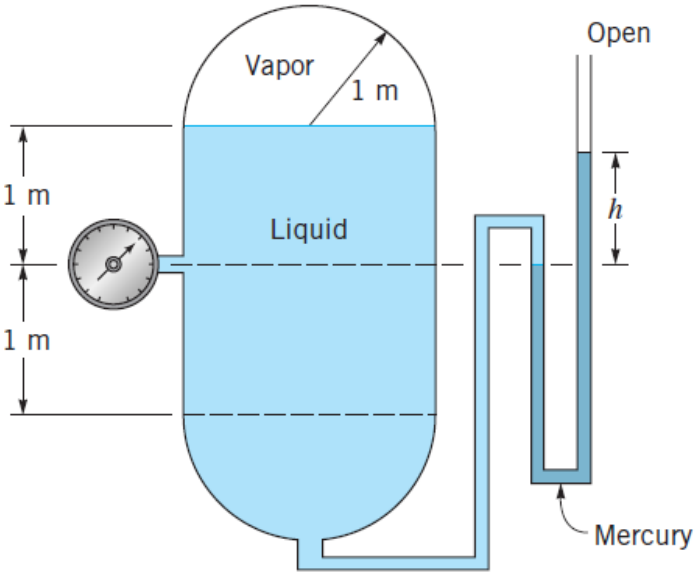

Fig. 5

7. The manometer fluid in the manometer of Fig. 7 has a specific gravity of 3.46. Pipes A and B both contain water. If the pressure in pipe A is decreased by 1.3 psi and the pressure in pipe B increases by 0.9 psi, determine the new differential reading of the manometer.

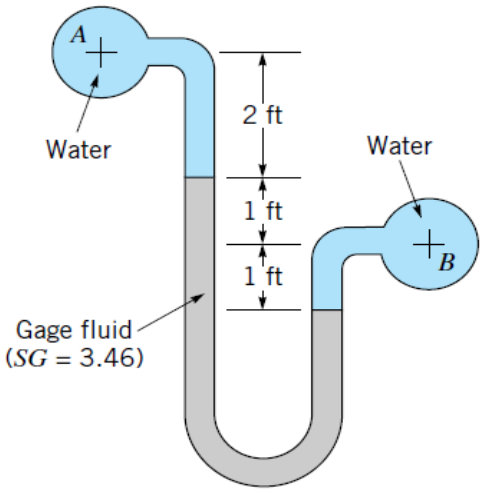

Fig. 7

8. Determine the new differential reading along the inclined leg of the mercury manometer of Fig.8, if the pressure in pipe A is decreased 10 kPa and the pressure in pipe B remains unchanged. The fluid in A has a specific gravity of 0.9 and the fluid in B is water.

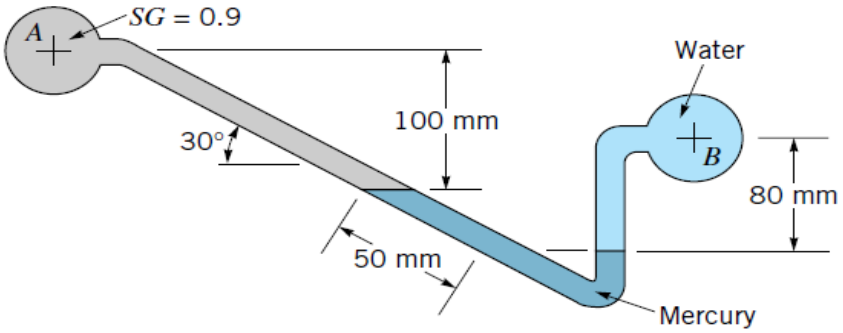

Fig.8

9. A homogeneous, 4-ft-wide, 8-ft-long rectangular gate weighing 800 lb is held in place by a horizontal flexible cable as shown in Fig.9 . Water acts against the gate which is hinged at point A. Friction in the hinge is negligible. Determine the tension in the cable.

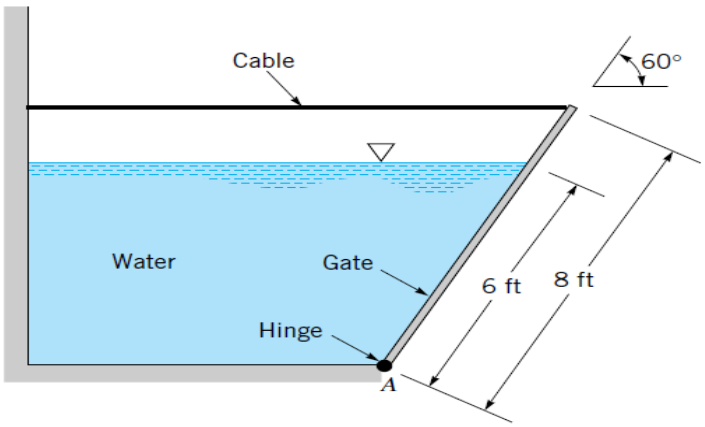

Fig.9

10. An area in the form of an isosceles triangle with a base width of 6 ft and an altitude of 8 ft lies in the plane forming one wall of a tank which contains a liquid having a specific weight of 79.8lb/ft^3. The side slopes upward making an angle of 60^0 with the horizontal. The base of the triangle is horizontal and the vertex is above the base. Determine the resultant force the fluid exerts on the area when the fluid depth is 20 ft above the base of the triangular area. Show, with the aid of a sketch, where the center of pressure is located.

11. Solve the above problem if the isosceles triangle is replaced with a right triangle having the same base width and altitude as the isosceles triangle.

12. A 4-m-long curved gate is located in the side of a reservoir containing water as shown in Fig.10. Determine the magnitude of the horizontal and vertical components of the force of the water on the gate. Will this force pass through point A? Explain.

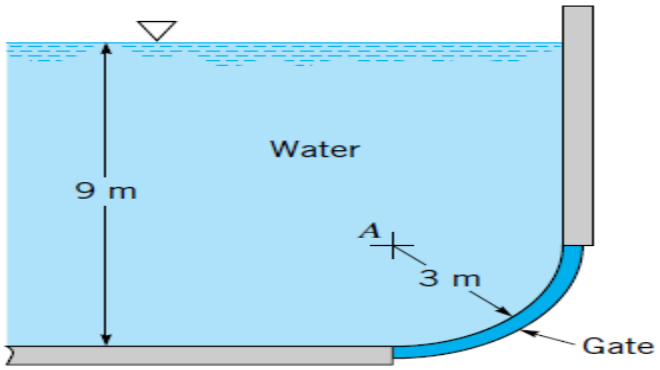

Fig. 10

13. Three gates of negligible weight are used to hold back water in a channel of width b as shown in Fig. 11. The force of the gate against the block for gate (b) is R. Determine (in terms of R) the force against the blocks for the other two gates.

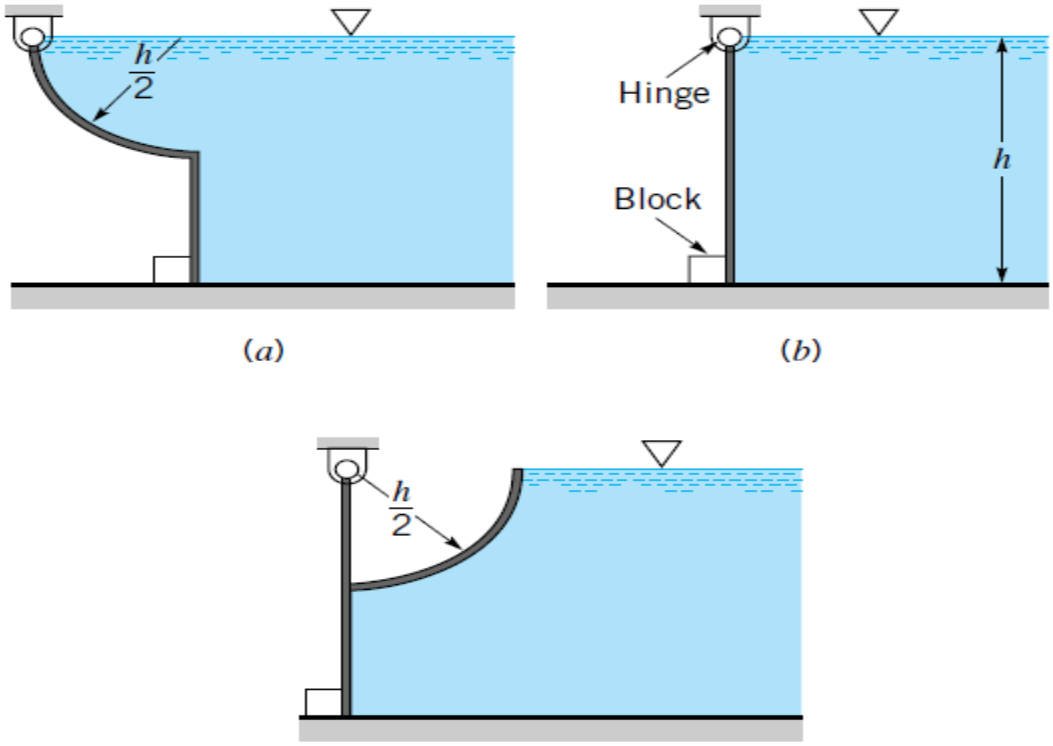

Fig. 11

14. A 3-m-wide, 8-m-high rectangular gate is located at the end of a rectangular passage that is connected to a large open tank filled with water as shown in Fig. 12. The gate is hinged at its bottom and held closed by a horizontal force, F_H, located at the center of the gate. The maximum value for F_H is 3500 kN (a) Determine the maximum water depth, h, above the center of the gate that can exist without the gate opening. (b) Is the answer the same if the gate is hinged at the top? Explain your answer.

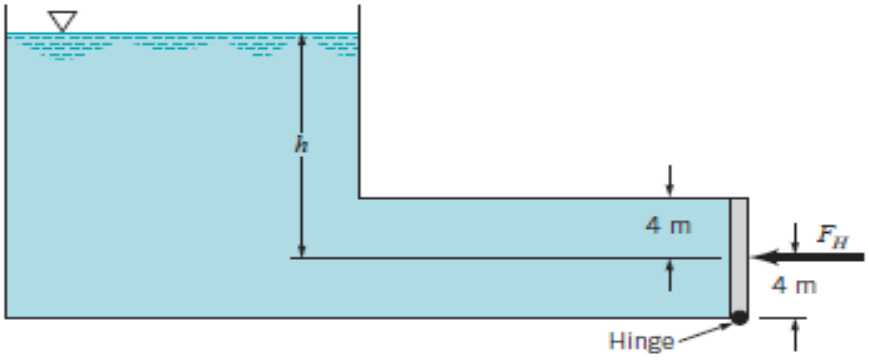

Fig. 12.

14. A rectangular gate that is 2 m wide is located in the vertical wall of a tank containing water as shown in Fig.13. It is desired to have the gate open automatically when the depth of water above the top of the gate reaches 10 m. (a) At what distance, d, should the frictionless horizontal shaft be located? (b) What is the magnitude of the force on the gate when it opens?

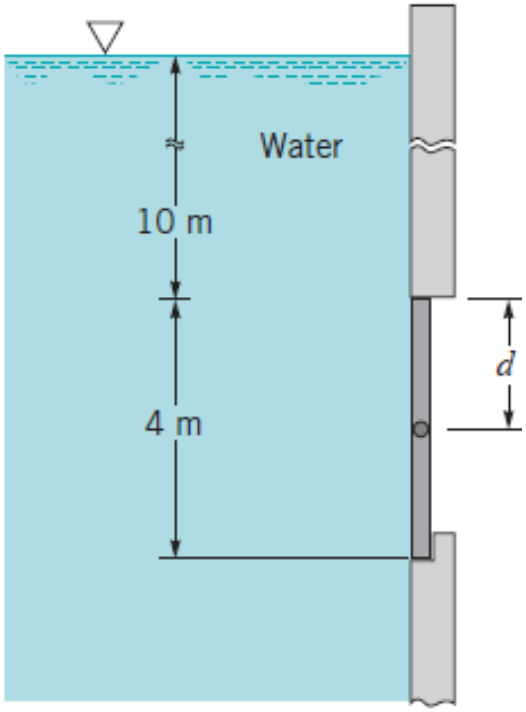

Fig.13

15. An open rectangular tank is 2 m wide and 4 m long. The tank contains water to a depth of 2 m and oil (SG = 0.8) on top of the water to a depth of 1 m. Determine the magnitude and location of the resultant fluid force acting on one end of the tank.
16. An open tank containing water has a bulge in its vertical side that is semicircular in shape as shown in Fig. 14. Determine the horizontal and vertical components of the force that the water exerts on the bulge. Base your analysis on a 1-ft length of the bulge.

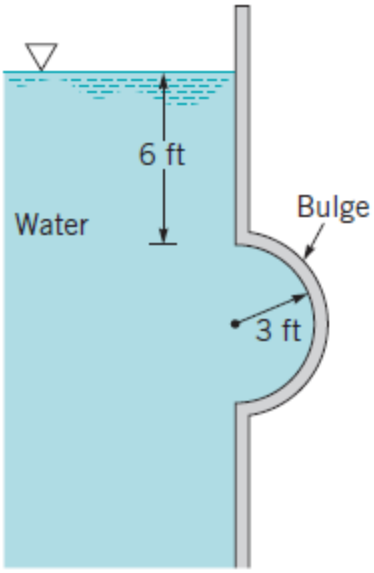

Fig. 14.

Reference books:

1. White, F.M.., “Fluid Mechanius.” Mc-Graw Hill, 2001
2. Cengel Y., “Fluid Mechanics”, McGraw Hill , 2001

Any other information:

In case of any difficulty, mail us at:

sumanth365k@gmail.com
ovais_23phd15@nitsri.net