LE COLLEGE MORBI

CO1 ASSIGNMENT

SUB: FMHM (3141906)

Chapters:Fluids and their properties,Pressure and Head,Static forces on surface and Buoyancy,Motion of Fluid particles and streams,

ATTEMPT FOLLOWING QUESTIONS WITH NEAT SKETCH IF NECESSARY

1)What is Compressibilty? Derive an Expression for it.

2) Derive an expression for capillary rise of liquid.

3) with neat sketch write about Newtonian fluid and Non-Newtonian fluids.

4) Define following terms:

a) Density b)Dynamic viscosity C) Kinematic Viscosity d)Capillarity e)Bulk modulus of elasticity f) surface tension g) Vapour Pressure h)Cavitation i) Cohesion) Adhesion

5) Explain Newton's law of viscosity.

6) Enlist types of manometers.Differntiate between U-Tube manometer and U-tube differential manometer.

7)Explain working of Bellows pressure gauge with schematic diagram.

8) what is fluid statics?what are the forces acting on the fluid particle in fluid statics?state pascal law.

9)Explain Bourden tube pressure gauge and Diaphragm gauge with neat sketch.

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10) Explain how the metacentric height of a floating body can be determined?

11) Explain Archimedes principle in detail.

12) Explain stability of submerged and floating bodies with neat sketches.

13) Explain stable,unstable,and neutral equilibrium with reference to floating body.

14) Derive continuity equation in 3-dimensional co-ordinate system.

15) Define rate of flow.derive also continuity equation.

16) Explain clearly : stream line,path line,and streak line.

17) Explain briefly: a) Steady flow and unsteady flow,b) Uniform flow and non-uniform flow,c) Laminar and turbulent floe.d) compressible flow and Incompressible flow.e) stream line,path line,and streak line.

18)In order to form a stream of bubbles, air is introduced through a nozzle into a tank of water at 20°C. If the process requires 3.0 mm diameter bubbles to be formed, by how much the air pressure at the nozzle must exceed that of the surrounding water? What would be the absolute pressure inside the bubble if the surrounding water is at100.3 kN/m2?Take surface tension of water at 20°C = 0.0735 N/m.(1.22)

19) Determine the minimum size of glass tubing that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.3 mm. Take surface tension of water in contact with air as 0.0735 N/m.(1.30)

20) Calculate the capillary effect in millimetres in a glass tube of 4 mm diameter, when immersed in (i) water and (ii) mercury. The temperature of the liquid is 20°C and the values of surface tension of water and mercury at 20°C in contact with air are 0.0735 N/m and 0.51 N/m respectively. The contact angle for water $\theta = 0°$ and for mercury $\theta = 130°$. Take specific weight of water at 20°C as equal to 9790 N/m3.(1.34)

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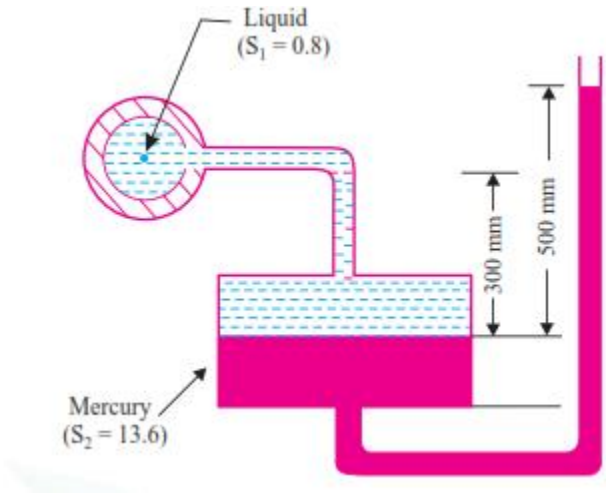
21) When a pressure of 20.7 MN/m2 is applied to 100 litres of a liquid its volume decreases by 1 litre. Find the bulk modulus of the liquid and identify this liquid.(1.38)

22) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate, which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine:
(i) The dynamic viscosity of the oil;
(ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.(1.5)

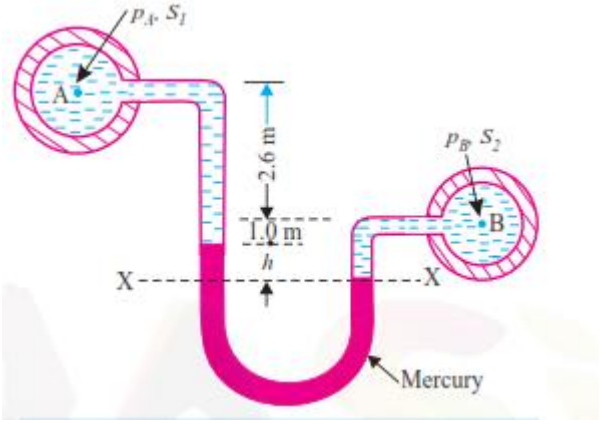
23) Fig shows a single column manometer connected to a pipe containing liquid of specific gravity 0.8. The ratio of area of the reservoir to that of the limb is 100. Find the pressure in the pipe.
Take specific gravity of mercury as 13.6.(2.17)



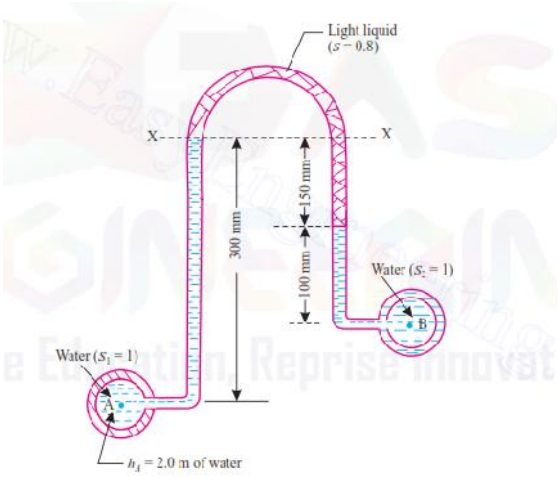
24) A differential manometer connected at the two points A and B in a pipe containing an oil of specific gravity of 0.9 shows a difference in mercury levels as 150 mm. Find the difference in pressures at the two points.(2.19)

25) Fig below shows a U-tube differential manometer connecting two pressure pipes at A and B. The pipe A contains a liquid of specific gravity 1.6 under a

pressure of 110 kN/m^2. The pipe B contains oil of specific gravity 0.8 under a pressure of 200 kN/m^2. Find the difference of pressure measured by mercury as fluid filling U-tube.(2.20)



26) Fig.below shows an inverted differential manometer having 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 metres of water.(2.22)



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27) An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil. Determine: **(i)** Total pressure on the plate; **(ii)** Centre of pressure.(3.3)

28) A trapezoidal plate of parallel sides l and 2l and height h immersed vertically in water with its side of length l horizontal and topmost. The top edge is at a depth h below the water surface(3.6). Determine:

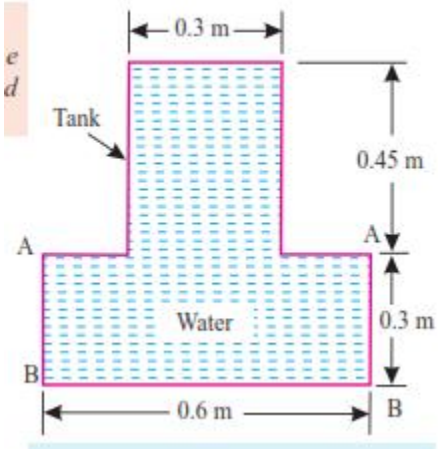
(i) The total force on one side of the plate.

(ii) The location of the centre of pressure.

29) A tank of 1m length and of cross-section shown in fig. below contains water. The tank is made of 4 mm steel plates.(3.16)

(i) What is the force on the bottom due to water?

(ii) What are the longitudinal tensile stresses in the side walls AB if (a) the tank is suspended from the top and (b) it is supported at the bottom?



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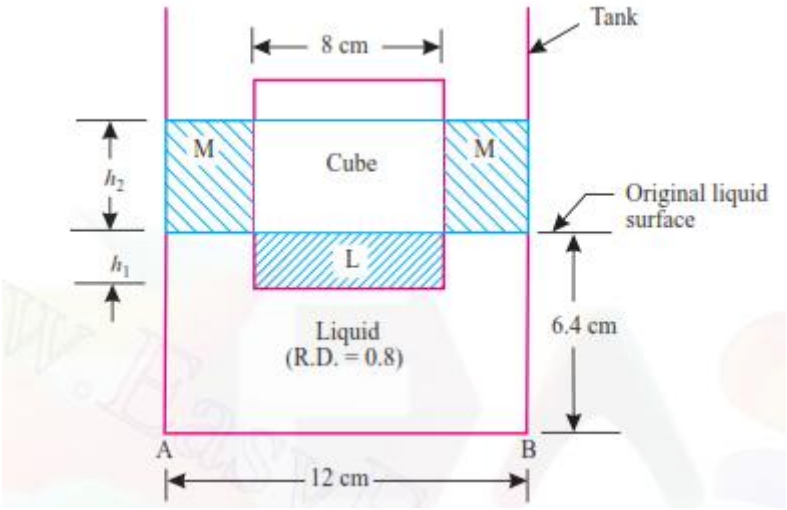
30) A 1m wide and 1.5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75 m below the free water surface.(3.19)

31) A 8 cm side cube weighing 4 N is immersed in a liquid of relative density 0.8 contained in a rectangular tank of cross-sectional area 12 cm × 12 cm. If the tank contained liquid to a height of 6.4 cm before the immersion, determine the levels of the bottom of the cube and the liquid surface.(4.5)



32) A wooden block of specific gravity 0.75 floats in water. If the size of the block is 1 m × 0.5 m × 0.4 m, find its metacentric height.(4.9)

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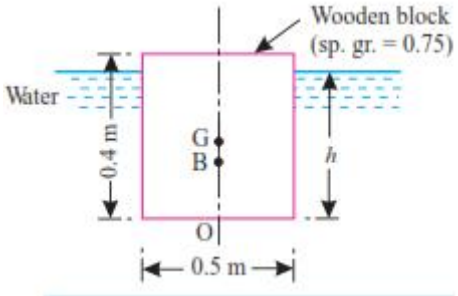

33) In a fluid, the velocity field is given by

$V = (3x + 2y)\, i + (2z + 3x^2)\, j + (2t - 3z)\, k$

Determine:

(i) The velocity components u, v, w at any point in the flow field;

(ii) The speed at point (1, 1, 1);

(iii) The speed at time t = 2s at point (0, 0, 2).

Also classify the velocity field as steady, or unsteady, uniform or non-uniform and one, two orthree dimensional.(5.1)

34) The diameters of a pipe at the sections 1-1and and 300 mm respectively. If the velocity through the pipe at section 1-1 is 4m/s, find:discharge through the pipe, and velocity of water at section 2-2(5.11)

35) A pipe (1) 450 mm in diameter branches into two pipes (2 and 3) of diameters 300 mm and 200 mm respectively as shown in Fig. 5.15. If the average velocity in 450 mm diameter pipe is 3 m/s find:

(i) Discharge through 450 mm diameter pipe;

(ii) Velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s(5.12)

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CO2 ASSIGNMENT

SUB: FMHM (3141906)

Chapters:Energy equations,Two-dimensional fluid flow,Dimensional analysis,Viscous flow and Turbulent flow

ATTEMPT FOLLOWING QUESTIONS WITH NEAT SKETCH IF NECESSARY

1) State 'Bernoulli's theorem'.what are the assumptions in Bernoulli's theorem?
2) Derive an expression for the measurement of velocity of flow at any point in a pipe or channel by pitot tube.
3) Derive an expression for the discharge through a venturimeter.
4) With usual notations derive the expressions for the discharge through a triangular notch.
5) Explain:Vena-conctracta. Discuss the characteristics of flow at vena-contracta in case of orifice.
6) Exaplain Buckingham's π-theorem method.
7) What is meant by dimensional analysis? What are its limitations and advantages?
8) Explain dynamic similarity between a prototype and its model.Describe Reynold's number and Froude's number used in the model analysis.
9) Explain Eular's,Weber and Mach model law.

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10)Explain different types of Hydraulic similarity that must exist between a prototype and model.

11) Derive an expression for the Hagen-Poiseuille's formula.

12) Define Reynold's number and give its significance .Explain Reynold's experiment with neat sketch.

13) Derive and sketch the velocity distribution for viscous flow through a circular pipe..using that prove the ratio of maximum velocity to the average velocity is 2.

14) Derive an expression for the loss of head due to friction in pipes.

15) write a short note on Moody diagram for calculating the head loss due to friction.

16) An orifice 50mm in diameter is discharging water under a head of 10 metres. If C_d =0.6 and C v=0.97, find(8.1)

(i) Actual discharge, and dv:

(ii) Actual velocity of the jet at vena contracta.

17) A 100 mm diameter orifice discharge 36 litres per second of water under a constant head of 2.6 m.A flat plate held normal to the jet just downstream from the orifice requires a force of 240 N to resist the impact of the jet.Determine the hydraulic co efficeints.(8.10)

18) A rectangular Notch 2.0 m wide has a constant head of 500 mm.find the discharge over notch.if co-efficient of discharge for the notch is 0.62.(8.11)

19) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is used to measure the flow of water. The pressure at inlet is 0.18

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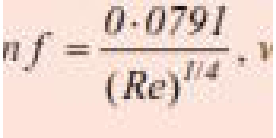
N/mm and the vacuum pressure at the throat is 280 mm of mercury. Find the rate of flow. The value of C_d may be taken as 0.98.(6.28)

20) Water flows at the rate of 0.015 m^3/s through a 100 mm diameter orifice used in a 200 mm pipe. What is the difference of pressure head between the upstream section and the vena contracta section? Take co-efficient of contraction Cc= 0.60 and Cv = 1.0.(6.40)

21) A smooth pipe of 80 mm diameter and 1000 m long is carrying water at the rate of 8 litres/sec. If the kinematic viscosity of water is 0·015 stokes and the value of co-efficient of friction 'f' is given by the relation f=



Calculate(11.6)

(i) Loss of head,

(ii) Wall shearing stress,

(iii) Centre-line velocity,

(iv) Velocity and shear stress at 20 mm from the pipe wall, and

(v) Thickness of laminar sublayer.

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CO3 ASSIGNMENT

Chapters: Impact of jet,Hydraulic turbines

SUB: FMHM (3141906)

ATTEMPT FOLLOWING QUESTIONS WITH NEAT SKETCH IF NECESSARY

1) Obtain an expression for the force exerted by a jet of a water on a fixed vertical plate in the direction of jet.
2) Obtain an expression for the force exerted by a jet of a water on a stationary curved plate ,with jet striking at the centre of plate .
3) Obtain an expression for the force exerted by a jet of a water the curved plate moving in the direction of jet.
4) Differentiate between impulse turbine and reaction turbine.Explain significance of specific speed.
5) What is draft tube? Why it is required in case of a reaction turbine?
6) Define Characteristics Curve.Explain main characteristic curves with figure.
7) Explain Various Efficiencies of Hydraulic turbine.
8) Draw a neat sketch of Pelton wheel and explain its various components.
9) A jet of water of diameter 20 mm strikes a 200 mm × 200 mm square plate of uniform thickness with a velocity of 10 m/s at the centre of the plate which is suspended vertically by a hinge on its top horizontal edge. The weight of the plate is 98 N. The jet strikes normal to the plate.

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a) What force must be applied at the lower edge of the plate so that plate is kept vertical ?

b) If the plate is allowed to deflect freely, what will be the inclination of the plate with vertical due to the force exerted by jet water?(1.8)

10) A rectangular plate, weighing 60 N is suspended vertically by a hinge on the top horizontal edge. The centre of gravity of the plate is 100 mm from the hinge. A horizontal jet ofwater 20 mm diameter, whose axis is 150 mm below the hinge impinges normally on the plate with a velocity of 5 m/s. Determine:

(i) The horizontal force applied at the centre of gravity to maintain the plate in its vertical portion.

(ii) The corresponding velocity of the jet, if the plate is deflected through 30° and the same force continues to act at the centre of gravity of the plate.(1.7)

11) A 75 mm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45° to the axis of the jet. Find the normal pressure on the plate,
(i) When the plate is stationary;
(ii) When the plate is moving with a velocity of 15 m/s in the direction of jet, away from the jet.Also determine the power and efficiency of the jet when the plate is moving.(1.10)

12) **(a)** A stationary vane having an inlet angle of zero degree and an outlet angle 25° receives water at velocity of 50 m/s. Determine the components of force acting on it in the direction of the jet velocity and normal to it. Also find the resultant force in magnitude and direction per kg of flow.
(b) If the vane stated above is moving with a velocity of 20 m/s in the direction of the jet, calculate the force components in the direction of the vane velocity and across it, also the resultant force in magnitude and direction. Calculate the work done and power developed per kg of flow.(1.14)

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13) The water available for a Pelton wheel is 4 m^3/s and the total head from the reservoir to the nozzle is 250 m. The turbine has two runners with two jets per runner. All the four jets have the same diameters. The pipe is 3 km long. The efficiency of transmission through the pipeline and the nozzle is 91 % and efficiency of each runner is 90 %. The velocity co-efficient of each nozzle is 0·975 and co-efficient of friction '4f' for the pipe is 0·0045. Determine :
(i) The power developed by the turbine,
(ii) The diameter of the jet, and
(iii) The diameter of the pipeline.(2.5)

14) The following data relate to a Pelton wheel :
Head ... 72 m
Speed of the wheel ... 240 r.p.m.
Shaft power of the wheel ...115 kW
Speed ratio ... 0·45
Co-efficient of velocity ... 0·98
Overall efficiency ... 85%
Design the Pelton wheel.(2.11)

15) A Pelton wheel generates 8000 kW under a net head of 130 m at a speed of 200 r.p.m. Assuming the co-efficient of velocity for the nozzle 0.98, hydraulic efficiency 87 percent,speed ratio 0.46, and jet diameter to wheel diameter ratio=1/9(2.46)
determine :
(i) Discharge required, **(ii)** Diameter of the wheel,
(iii) Diameter and number of jets required, and **(iv)** Specific speed.
Mechanical efficiency is 75 per cent.

16) A hydraulic turbine is to develop 1015 kW when running at 120 r.p.m. under a net head of 12 m. Work out the maximum flow rate and specific speed for the turbine if the overall efficiency at the best operating point is 92 per cent. In order to predict its performance, a 1 : 10 scale model is tested under a head of 7.2 m. What would be the speed, power output and water consumption of the model if it runs under the conditions similar to the prototype ?(2.54

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CO4 ASSIGNMENT

Chapters : Flow through Pipes,Centrifugal pumps,Hydraulic Machines

SUB: FMHM (3141906)

ATTEMPT FOLLOWING QUESTIONS WITH NEAT SKETCH IF NECESSARY

1) Explain the terms:
   a) Hydraulic grade line b) Total energy line c) Equivalent pipe
2) Derive an expression for loss of head due to sudden contraction.
3) Derive an expression for loss of head due to sudden enlargement.
4) Explain pipes in series and pipes in parallel.
5) Derive Darcy-Weisbach equation for loss of head in a pipe due to friction.
6) Explain cavitation in turbines and centrifugal pumps and write the effects.
7) Explain characteristics of curves of centrifugal pumps with neat sketch.
8) Explain Net positive suction head(NPSH) in pumps.
9) Explain pumps in series and pumps in parallel.
10) Explain main parts and working principle of Centrifugal pump with a neat sketch.
11) Explain working of Hydraulic accumulator with neat sketch.
12) Explain the principle and working of Hydraulic press with neat sketch.

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13) Explain working of Hydraulic ram with neat sketch.

14) Explain working of Hydraulic torque convertor with neat sketch.

15)what is difference between fluid coupling and fluid torque convertor?Explain the torque convertor with neat sketch.

16) A centrifugal pump rotating at 1500 r.p.m. delivers 0.2m /s at a head of 15 m. Calculate the specific speed of the pump and the power input. Assume overall efficiency of the pump as 0.68.If this pump were to operate at 900 r.p.m. what would be the head, discharge and power required for homologous conditions? Assume overall efficiency remains unchanged at new r.p.m.(3.23)

17) In order to predict the performance of a large centrifugal pump, a scale model of one - sixth size was made with the following specifications: Power P = 25 kW; Head H = 7m; Speed N = 1000 r.p.m. If the prototype pump has to work against a head of 22 m, calculate its working speed, the power required to drive it, and the ratio of the flow rates handled by the two pumps.(3.32)

18) In a pipe of diameter 350 mm and length 75 m water is flowing at a velocity of 2·8 m/s. Find the head lost due to friction using : **(i)** Darcy-Weisbach formula; **(ii)** Chezy's formula for which C = 55. Assume kinematic viscosity of water as 0·012 stoke.(12.1)

19) Water is to be supplied to the inhabitants of a college campus through a supply main. The following data is given : Distance of the reservoir from the campus = 3000 m, Number of inhabitants = 4000, Consumption of water per day of each inhabitant = 180 litres,Loss of head due to friction = 18 m,Co-efficient of friction for the pipe, f = 0·007,If the half of the daily supply is pumped in 8 hours, determine the size of the supply main.(12.4)

20) The diameter of a horizontal pipe which is 300 mm is suddenly enlarged to

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600 mm. The rate of flow of water through this pipe is 0·4 m^3/s. If the intensity of pressure in the smaller pipe is 125 kN/m^2
, determine.(12.10)
(i) Loss of head, due to sudden enlargement,
(ii) Intensity of pressure in the larger pipe, and
(iii) Power lost due to enlargement.

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