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QUESTION BANK (DESCRIPTIVE)

Subject with Code : FM(18CE0104) **Course & Branch**: B.Tech - CE

Year & Sem: II-B.Tech & I-Sem **Regulation:** R18

UNIT –I

FLUID PROPERTIES AND FLUID STATICS

1. a) State Pascal's law. What do you understand the terms Absolute, Gauge, Atmospheric & Vacuum pressure. 5M

   b) What is the gauge pressure at a point 3m below the free surface of a liquid having a Density of 1.53 X 10^3 kg/m^3.If the atmospheric pressure is equivalent to 750mm of Mercury? The Specific gravity of mercury is 13.6 and density of water = 1000 kg/m^3 5M

2. Define Manometer. Briefly explain the types of manometers in detail. 10M

3. A U-tube manometer is used to measure the pressure of water in a pipe line, which is Excess of atmospheric pressure. The right limb of manometer contains mercury and is Open to atmosphere. The contact between water and mercury is in the left limb. Determine The pressure of water in the main line, if the difference in the level of mercury in the limbs Of U-tube is 10 cm and the free surface of mercury is in level with the centre of pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, calculate the new difference In the level of mercury. Sketch the arrangements in the both cases. 10M

4. a) An inverted U – tube manometer is connected to two horizontal pipes A and B though which water is flowing? The vertical distance between the axes of these pipes is 30 cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. determine the difference of pressure between the pipes. 5M

   b) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of Diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown? If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 r.p.m; determine the viscosity of the fluid. 5M

5. a) Define Hydro static law and derive the condition for pressure head 5M

   b) Derive the condition for capillary rise and capillary fall. 5M

6. Derive expressions for the total pressure and centre of pressure for an inclined plane Surface submerges in the liquid. 10M

7. Explain how you would find the resultant pressure on vertical surface immersed in the liquid. 10M

8. Define centre of pressure and derive an expression for centre of pressure for a vertically submerged surface. 10M

9. a) A rectangular plane surface 3 m wide and 4 m deep lies in water in such a Way that its plane makes an angle of 30 degrees with the free surface of water. Determine the total pressure force and position of centre of pressure, when the Upper edge is 2 m below the free surface. 5M

   b) Find the magnitude and direction of the resultant force due to water acting on a Roller gate of cylindrical form of 4 m diameter, when the gate is placed on the Dam in such a way that water is just going to spill. Take the length of the gate As 8m. 5M

10. a) How does viscosity of a fluid vary with temperature? 5M

    b) Cite examples where surface tension effects play a prominent role. 5M

UNIT – II

FLUID KINEMATICS

1. Obtain an expression for continuity equation for three - dimensional flow. 10M

2. Classify different types of flows in motion . 10M

3. Define the following

i) stream line 2M

ii) streak line 2M

iii) path line 2M

iv) stream tube 2M

v) control volume 2M

4. a) Obtain an expression for continuity equation for one - dimensional flow 5M.

b) A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s. Find the discharge in the pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. 5M

5. The velocity vector in a fluid flow $V= 4x^3i-10x^2yj+2tk$, find the velocity and acceleration of a fluid particle at (2, 1, 3) at time t=1. 10M

6. a)Write short notes on velocity potential function 5M

b) The velocity potential function is given by $Ø = 5(x^2 – y^2)$. Calculate the velocity components at the point (4, 5). 5M

7. a)Write short notes on Stream function 5M

b) A stream function is given by $\psi = 5x – 6y$. Calculate the velocity components and also magnitude and direction of the resultant velocity at any point 5M

8. a) Define compressible and incompressible flows. 2M

b) Define laminar and turbulent flows. 2M

c) Define uniform and non-uniform flow. 2M

d) Define between rotational and irrotational flow. 2M

e) Define between steady and unsteady flow 2M

9. If for a two – dimensional potential flow, the velocity potential is given by $Ø = x (2y – 1)$. Determine the velocity at the point P (4, 5). Also determine the value of stream function Ψ at the point P 10M

10. Write short notes on

a) Stream function 5M

b) Velocity potential function 5M

UNIT – III
FLUID DYNAMICS

1. What is Euler's equation of motion? How do you obtain Bernoulli's equation from it? Name the different forces present in a fluid flow 10M

2. a) Derive the expression for rate of flow through venturimeter. 5M

b)A horizontal venturimeter with inlet and throat diameters 30cm and 15 cm is used to measure the flow of water . The reading of differential manometer connected to the inlet and throat is 20 cm of mercury. Determine the rate of flow . Take c_d=0.98 5M

3. a) Explain pitot tube and pitot static tube. 5M

b) A sub-marine moves horizontally on a sea and has its axis 15m below the surface of water. A pitot tube properly placed just in front of a sub-marine and along its axis is connected to two limbs of a u – tube containing mercury. The difference of mercury level is found to be 170mm find the speed of the sub-marine knowing that the specific gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water. 5M

4. A vertical wall is of 8 m height. A jet of water is coming out from a nozzle with a velocity of 20 m/s. The nozzle is situated at a distance of 20 m from the vertical wall. Find the angle of projection of the nozzle to the horizontal so that the jet of water just clears the top of the wall 10M

5. Water is flowing through a pipe has diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lit/s 10M

6. a) Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43N/cm^3 (gauge) and with mean velocity of 2.0 m/s. Find the total head or total energy per unit weight of the water at a cross section which is 5 m above the datum line. 5M

b)In a 100mm horizontal pipe a venturimeter of 0.5 contraction ratio has been fixed.The head of watr on the meter when there is no flow is 3m(guage). Find the rat of flow for which the throat pressure will be 2m of water absolute. The co efficient of discharge os 0.97.Take atmospheric pressure head =10.3 m of water. 5M

7. Explain the principle of orifice meter and derive the equation to find the rate of flow of water through a pipe using the same 10M

8. Analyze force excerted by flowing fluid on a pipe bent 10M

9. A 45^o reducing bent is connected in a pipe line. The diameters at inlet and outlet of bent are 600 mm and 300 mm respectively. Find the forces excerted by water on the bent if the intensity of the pressure at inlet is 8.829 N/cm^2 and rate of flow of water is 600 ltr/sec. 10M

10. a) An orifice meter with orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gauges fitted up stream and down stream of 19.62N/cm^2 and 9.81N/cm^2 respectively co-efficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe 5M

b) The following data relate to an orifice meter

Diameter of the pipe = 240mm
Diameter of the orifice = 120mm
Specific gravity of oil = 0.88
Reading of differential manometer = 400mm of mercury
Co – efficient of discharge of the meter = 0.65

Determine the rate of flow of oil. 5M

UNIT IV
FLOW THROUGH PIPES

1. Derive the expression for head loss in pipes due to friction- Darcy - Weisbach equation. 10M

2. a) Derive the expression for flow through pipes in series. 5M

   b) Derive the expression for flow through parallel pipes. 5M

3. The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m, 210 m and of diameters 300mm, 200 mm, 400 mm respectively, is 12 m. Determine the rate of flow of water if co-efficient of friction are 0.005,0.0052 and0.0048 respectively , considering :(1)minor losses also (2)neglecting minor losses. 10M

4. Derive the condition for loss of head due to sudden enlargement 10M

5. a)Derive the condition for loss of head due to sudden contraction 5M

   b) Find the loss of head when the pipe of diameter 200mm is suddenly enlarged to a diameter of 400mm.The rate of flow of water through the pipe is 250litres/s. 5M

6. At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient raises by 10mm .Estimate the rate of flow. 10M

7. Write short notes on

   a) Loss of head at the entrance of pipe 3M

   b)Loss of head at the exit of the pipe 3M

   c) Loss of head due to obstruction in a pipe 4M

8. A150mm diameter pipe reduces in diameter abruptly to 100mm diameter. If the pipe carries water at 30liters per second, calculate the pressure loss across the contraction. Take the co efficient of contraction as 0.6. 10M

9. A horizontal pipe of diameter 500mm is suddenly contracted to a diameter of 250mm. The pressure intensities in the large and small pipe is given as 13.734 N/cm^2 and 11.772 N/cm^2.Find the loss of head due to contraction if c_c=0.62.Also determine the rate of flow of water. 10M

10. a) Write short notes on flow through syphon 5M

    b) A syphon of diameter 200mm connects two reservoirs having a difference in elevation of 20m .

    The length of syphon is 500m & the summit is 3m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100m.Determine the discharge through syphon and also pressure at the summit, neglect minor losses. The co efficient of friction is f=0.005.

    5M

UNIT – V

LAMINAR FLOW AND TURBULENT FLOW

1. Briefly explain Reynolds experiment. 10M

2 a) Derive the condition for drop pressure for a given length (L) of a pipe. 5M

b) Derive the condition for ratio of maximum velocity to average velocity. 5M

3. Derive an expression for velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution across a section of pipe. 10M

4. A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100mm and of length 10m. Calculate the difference of pressure at the two ends of the pipe, if 100kg of the oil is collected in a tank in 30 seconds. 10M

5. A laminar flow is taking place in a pipe of diameter 200mm. The maximum velocity is 1.5m/s .Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 4 cm from the wall from the pipe. 10M

6. Derive an expression for flow of viscous fluid between two parallel plates. Also sketch and derive the velocity distribution across a section of pipe. 10M

7. Briefly explain

a) Shear stress distribution in parallel plates. 5M

b) Drop of pressure head for a given length in parallel plates. 5M

8 .Derive the condition for velocity distribution for turbulent flow in smooth pipes. 10M

9. Obtain the expression for velocity distribution in turbulent flow for (i) smooth pipes (ii) rough pipes

10. How would you distinguish between hydrodynamically smooth and rough boundaries? 10M