Total No. of Questions : 12]

SEAT No. : [ ]

P3584

[Total No. of Pages : 4

[5152]-506
S.E. (Civil Engineering) (Semester - II)
FLUID MECHANICS - I
(2015 Pattern)

Time : 2 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Answer any six questions from Q. No.1 OR 2, Q. No.3 OR 4, Q. No.5 OR 6, Q. No.7 OR 8, Q. No.9 OR 10,Q. No.11 OR 12.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Define the following properties and state their units **[2]**

i) Bulk modulus of elasticity

ii) specific weight

b) Unit IDistinguish between : **[3]**

i) Adhesion and cohesion

ii) Newtonian and non-Newtonian fluids

OR

Q2) a) Derive an expression for a pressure inside a liquid jet of radius R and surface tension σ **[3]**

b) Discuss in brief - why water shows capillary rise and mercury shows capillary depression **[2]**

Q3) a) Explain the three states of equilibrium of a floating body with reference of its metacentric height. **[3]**

b) Define Buoyancy and centre of Buoyancy **[2]**

OR

P.T.O.

Q4) a) State and explain Pascal's law. **[2]**

b) Explain in brief - Pressure Transducers **[3]**

Q5) a) $u= x^2 + y^2 + 2z^2$, $v = -x^2y - yz - xy$, find ω to satisfy continuity. **[3]**

b) Distinguish between rotational and irrotational flow. **[2]**

OR

Q6) a) Define stream line and streak line and give the example of each. **[2]**

b) Obtain a stream function to the following velocity components, U=x + y, and v = x - y **[3]**

Q7) a) What do you understand by dynamics of fluid flow? How does it differ from kinematics of fluid flow? **[2]**

b) State the Bernoulli's equation. Explain each term of it in short. **[3]**

OR

Q8) a) Draw a neat sketch of Rotameter and explain its working in brief **[3]**

b) Explain the terms briefly : **[2]**

i) Potential head,

ii) Velocity head.

Q9) a) Laminar flow takes place in a circular tube. At what distance from the boundary does the local velocity equal to the average velocity - Derive? **[5]**

b) What is boundary layer? Explain with neat sketch the development of boundary layer over a smooth flat plate. **[5]**

c) A laminar flow of oil of absolute viscosity 0.20N-s/m^2 and density 900kg/m^3 flows through a pipe of diameter of 0.35m. If the head loss of 25m is observed in a length of 2500m. determine : **[5]**

i) The velocity of flow,

ii) Reynold's number,

iii) Friction factor.

OR

Q10)a) Derive an expression for the velocity distribution between two horizontal stationary plates separated by a small gap when a viscous liquid flows through them. **[5]**

b) For a steady laminar flow in a horizontal circular pipe derive expression for : **[5]**

i) Shear stress.

ii) The pressure drop

c) A fluid of viscosity 0.8 N-s/m^2 and specific gravity 1.2 is flowing through a circular pipe of diameter 100mm. The maximum shear stress at the pipe wall is given as 200.2 N/m^2. **[5]**

Find :

i) The pressure gradient,

ii) The average velocity,

iii) Reynold's number of the flow

Q11)a) A farmer wishes to connect two pipes of different lengths and diameters to a common header supplied with 8 x10^{-3} m^3/s of water from a pump. One pipe is 100mm long and 5cm in diameter. The other pipe is 800m long. Determine the diameter of the second pipe such that both pipes have the same flow rate. Assume the pipes to be laid on level ground and friction coefficient for both pipes as 0.02. Also determine the head loss in meters of water in the pipes. **[5]**

b) Derive Karman - Prandtl equation for velocity distribution in turbulent flow near hydrodynamically smooth boundary. **[4]**

c) Write short note on : **[6]**

i) Prandtl's mixing length theory,

ii) Hydrodynamically smooth and rough pipes

OR

Q12)a) Three pipes ,300m long and 300mm diameter, 150m long and 20mm dia. 200m long 250mm dia. are connected is connected in series in same order. Pipe having 300mm diameter is connected to the reservoir. Water level in the reservoir is 15m above the centerline of the pipe which is horizontal. The respective friction factor for the pipes are 0.018, 0.02, and 0.019. Determine **[6]**

i) Flow rate

ii) Magnitude of loss of head in each pipe

The equivalent diameter of the single replacing the three pipes.

b) Define minor energy losses and major energy losses in pipe. Enlist various types of minor losses in pipe flow. **[4]**

c) Derive the equation for frictional losses for flow through pipe as **[5]**

$$hf = \frac{fLV^2}{2gD}$$