(6)

Total No. of Questions-12 Total No. of Printed Pages-04

S.E. (Civil) (I Sem.) EXAMINATION, 2014
FLUID MECHANICS I
(2008 PATTERN)

Time: Three Hours Maximum Marks: 100

N.B. :- (i) Answer *three* questions from Section I and *three* questions from Section II.
(ii) Answers to the two Sections should be written in separate answer-books.
(iii) Neat diagrams must be drawn wherever necessary.
(iv) Use of logarithmic tables, slide rule, electronic calculator is allowed.
(v) Assume suitable data, if necessary.

SECTION I

Q.1 a) The velocity distribution for flow over a plate is given as (10)

$u = 2y - y^2$

where ,u is the velocity in m/s at a distance y metres above the plate Determine velocity gradient and the shear stress at the boundary and 1.5 m from it.

b) What is meant by geometric and kinematic similarities ? (06)

OR

Q.2 a) Write a short note on 'Vapour Pressure' (06)

b) Prove that the shear stress in a fluid flowing through a pipe can be expressed by the equation : $\tau = \rho V^2 f(\mu/\rho VD, k/D)$ (10)

Where, D = Diameter of Pipe

ρ = mass density

V = Velocity

k= height of roughness projection, and

μ- viscosity

Q.3 a) Derive an expression for total pressure on a curved surface submerged in the liquid. (09)

b) A rectangular tank is filled with kerosene of specific gravity 0.805 to a depth of 0.6 m and carbon disulphide of specific gravity 1.292 to a depth of 0.3m. Determine the total pressure force per meter length of the side wall of the tank and depth of centre of pressure. Assume that the two liquids are immiscible. (09)

OR

Q.4 a) Describe in short different types of manometers. What are their uses and limitations. (10)

b) Define the following terms (08)

i. Metacentre and
ii. Metacentric height

Derive an equation for determination of Metacentric height analytically.

Q.5 a) In an incompressible flow , the velocity vector is given as (08)

$V=(6xt + yz^2)\, i + (3t + xy^2)\, j + (xy - 2xyz - 6tz)\, k.$

Verify whether the continuity equation is satisfied. Determine the accleration vector at point (2,2,2) at t= 2.0

Q.5 b) In a two-dimensional incompressible flow, the velocity components are (08)

$u = 2x$, $v = 1 - 2y$, Find the stream function and velocity potential function.

OR

Q.6 a) State principle of conservation of mass and hence derive continuity equation for one dimensional flow. (10)

b) Define the following terms. (06)

(i) Flow net (ii) stream function (iii)unsteady uniform flow

SECTION II

Q.7 a) A vertical sharp edge orifice 120 mm diameter is discharging water at the rate of 98.2 litre/sec under a constant head of 10 m. A point on the jet ,measured from the vena contracta of the jet has co-ordinates 4.5 m horizontal and 0.54m vertical. Find the following for the orifice (10)
(i) Co-efficient of velocity
(ii) C0-efficient of discharge and
(iii)Co-efficient of contraction

b) What is a pitot tube ?How is it used to measure the velocity of flow at any point in a pipe ,explain with sketch. (04)

c) Explain the terms briefly: (04)
(i) Hydraulic gradient line (ii)Total energy line

OR

Q.8 a) Derive equation for the actual discharge Q_a with the help of neat sketch for Venturimeter fitted in a horizontal pipe. (06)

b) Explain clearly with neat sketch (06)
(i) kinetic energy correction factor
(ii) Hydraulic gradient line

(iii) Pitot tube.

c) A 25 mm diameter orifice discharges water under 5.5 m head at the rate of 3 litre per second . If the water jet strikes a point 1.5m away and 0.12m below the center line of the vena contracta , compute the three hydraulic coefficients of the orifice (06)

Q.9 a) Briefly explain (i) Stoke's law (ii) Darcy' (04)

b) A liquid of density 900 kg/ m^3 and viscosity 0.2 Pas flows through a120 mm diameter pipe such that Reynolds's number is 1000 for the flow. Find the shear stress and velocity at appoint 20mm from the pipe wall. (06)

c) Explain the concept of hydrodynamically smooth and rough pipes with sketches (06)

OR

Q.10 a) If the velocity velocity profile in a boundary layer is given as $\frac{u}{U}=\left(\frac{y}{\delta}\right)$ obtain displacement thickness and momentum thickness of boundary layer in terms of δ (04)

b) Derive equation for point velocity in case of laminar flow between parallel plates, both at rest. Draw relevant sketches for velocity variation and small element in the flow. (06)

c) An oil (S.G.=0.8 and μ=0.4 poise) flows under laminar conditions through a 0.1 m diameter horizontal pipe at the rate of 0.95 liters per second .Determine wall shear stress and power required for 400m length of pipe. (06)

Q.11a) Write a note on Prandtl Mixing length theory (04)

b) Using Reynold's theory , Prandtl's theory and Karman's hypothesis obtain velocity distribution equation for turbulent flow through pipe (06)

c) An oil (S.G.=0.8 and μ=0.4 poise) flows under laminar conditions through a 0.1 m diameter horizontal pipe at the rate of 0.95 liters per second .Determine wall shear stress and power required for 400m length of pipe. (06)

OR

Q.12 a) State eight characteristics of turbulent flow. (04)

b) Explain Moody's diagram and its use with neat sketch. (06)

c) With the help of sketches, explain the working of a siphon. Explain its necessity (applications) (06)