EI-190

B.E. (IVth Sem.) (CGPA) Civil Engg. Exam.-2015

FLUID MECHANICS - I

Paper - CE - 403

Time Allowed : Three Hours

Maximum Marks : 60

Note : All questions are compulsory.

Q.I (a) Define Viscosity, Absolute pressure, gauge pressure and vaccum pressure. 4

(b) Two large plane surface are 20mm apart, and space between them is filled with glycerine. Determine the force required to drag a thin plate of area $0.5m^2$ at speed of 0.5m/s if :

(i) Thin plate is in the middle

(ii) It is at a distance of 6mm from one surface. 8

Or

What are the absolute and gauge pressure at a point 3m below the free surface of a liquid having specific weight of 1.53×10^3 Kg (f)/m^3. If the atmosphere pressure is 750mm of mercury? Consider specific gravity of mercury as 13.6. 12

Q.II (a) Explain steady and unsteady flow and uniform and non uniform flow. 4

(b) Derive continuity equation in 3-Dimension. 8

Or

An open circular tank of 20cm diameter and 100cm length, contains water upto a height of 60cm. The tank is rotated about its vertical axis at 300 rpm, find the depth of parabola formed at the free surface of waters. 12

Q.III (a) What are the assumptions made in the derivation of Bernoulli's equation? 4

(b) Derive the following expression for rate of flow through venturimeter.

$$\theta = \frac{a_1 a_2}{\sqrt{a_1^2 - a_2^2}} \cdot \sqrt{2gh}$$

8

Or

A 20cm × 10cm venturimeter is inerted in a vertical pipe carrying oil of specific gravity 0.8, the flow of oil is in upward direction. The difference of levels between the throat and inlet section is 50cm. The oil mercury differential monorneter gives a reading of 30cm mercury. Find the discharge of oil, neglect losses. 12

Q.IV (a) Give the dimensions of force, viscosity, power and acceleration. 4

(b) The variables controlling the motion of a floating vessel through water are the drag force F, speed V, length L, density ρ and dynamic viscosity M of water and acceleration due to gravity 'g'. Derive an expression for 'F' through dimensional analysis. 8

Or

Ratio of lengths of a submarine to its model is 20 : 1. The speed of submarine (prototype) is 10m/s. The model is to be tested in a wind tunnel. Find the speed of air in wind tunnel. Also determine the ratio of the drag (resistance) between the model and its prototype. Take the value of Kinematic viscosities for sea water and air as 0.012 stokes and 0.016 stokes respectively. Density of sea water and air is given a 1030 Kg/m^3 and 1.24 Kg/m^3. 12

Q.V (a) Differentiate between laminar and turbulent flow. 4

(b) Show that discharge per unit width between two parallel plates, distance 'b' apart is

$$q = \frac{Vb}{3}$$

when one plate is moving at velocity 'v' while other one is held stationary. 8

Or

A pipe 60cm dia. and 400mm long stopes upwards at lin50. An oil of viscosity 0.9N-s/m^2 and sp. gravity 0.9 is required to pumped at a rate of 5l/s. Determine : 12

(a) Nature of flow

(b) Pr. difference required to attain this condition

(c) Centre line velocity and velocity gradient at pipe wall.