CE ME AU IP IEM ME-405 FLUID MECHANICS DEC 12

Note : (i) Attempt all questions. (ii) Assume suitable data if necessary.(iii) All questions carry equal marks.

1. (a) Explain the terms -

(i) Real fluids (ii) Vapour pressure (iii) Compressibility (iv) Viscosity.

(b) Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate having*surface area 1.0 m^2 is pulled at 0.3 m/s. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity 1.5 poise.

Or

(a) Calculate the specific weight, density and specific gravity of two litres of a fluid which weight.

(b) Calculate the capillary rise in a glass tube of 3.0 mm diameter when immersed vertically in (i) Water and (ii) Mercury. Take surface tension for mercury and water as 0.0725 N/m and 0.52 N/m respectively in contact with air. Specific gravity for mercury is 13.6.

2 (a) Derive the expression for total pressure and centre of pressure for a vertical plane surface submerged in liquid.

(b) A tank contains water upto a height of 0.5 m above base. An immiscible liquid of sp. gr. 0.8 is filled on top of water upto height lm. Calculate-

(i) Total pressure on one side of the tank.

(ii) Position of centre of pressure, if width is 2.0 m.

Or

(a) Define Metacentre and derive an expression for metacentre height.

(b) A uniform body of size 3m x 2m * lm floats in water. What is the weight of the body if depth of immersion is 0.6 m ? Determine the metacentric height also.

(a) Derive an expression for -

(i) Stream function

(ii) Velocity function.

(b) The stream function for a two dimensional flow is given by q/ = 8xy, calculate the velocity at the point (4,5), and velocity potential function.

Or .

(a) Derive an expression for continuity for a three dimensional steady incompressible flow.

(b) The two velocity components for a flow are given as $u = 4X^2$, v = 4xy, determine the third component of velecity such that they satisfy the continuity equation.

3.(a) Describe Euler's equation of motion and obtain'Bernoulli's equation from it.

(b) A 30 cm diameter pipe carries water under a head of 15 metres with a velocity of 4m/s, if the axis of the pipe turns through 45°. Find the magnitude and direction of the resultant force at bend.

Or

(a) Define notch and weir. Derive an expression for discharge over a triangular notch or weir.

(b) A 30 cm x 15 cm venturimeter is inserted in a vertical pipe carrying water flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives a reading of 20 cm. Find discharge. Take C_d - 0.98.

5. Write short notes on any four -

(i) Dimensionless numbers

(ii) Similarity laws

(iii) Buckingham-pi theorem

(iv) Distorted and undistorted model

(v) Stoke's law

(vi) Laminar flow through porous media

(vii) Reynold experiment of Reynold number

(viii) Laminar flow between parallel plates

(ix) Lubrication principle

(x) Laminar flow through circular pipes.