

COURSE NAME: B.Tech

BRANCH NAME: Civil Engineering

FULL MARKS: 30

SUBJECT NAME: Fluid Mechanics

Jay Jagannam SEMESTER: 5

TIME: 90 Minutes

Answer All Questions.

The figures in the right hand margin indicate Marks. Symbols carry usual meaning.

Q1. Answer all Questions.

[2 × 3]

- CO1

- CO2

- CO3

Q2. (a) Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very thin plate of surface area 0.5 square metre between the two large plane surfaces at a speed of 0.6 m/s, if:

[8]

- (i) the thin plate is in the middle of the two plane surfaces, and
(ii) the thin plate is at a distance of 0.8 cm from one of the plane surfaces ?
Take the dynamic viscosity of glycerine = $8.10 \times 10^{-1} \text{ N s/m}^2$.

- CO1

OR

(a) The diameters of a small piston and a large piston of a hydraulic jack are 3 cm and 10 cm respectively. A force of 80 N is applied on the small piston. Find the load lifted by the large piston when :

- CO1

- (i) the pistons are at the same level
(ii) small piston is 40 cm above the large piston.

Q3.

[8]

(a) Find the total pressure and position of centre of pressure on a triangular plate of base 2 m and height 3 m which is immersed in water in such a way that the plane of the plate makes an angle of 60° with the free surface of the water. The base of the plate is parallel to water surface and at a depth of 2.5 m from water surface ?

- CO2

OR

(a) Explain the terms "meta-centre" and "meta-centric height". Derive an expression for the meta-centric height of a floating body (analytical method).

- CO2

Q4.

(a) Define the equation of continuity. Obtain an expression for continuity equation for a three-dimensional flow with neat sketch.

[8]

- CO3

OR

(a) A fluid flow field is given by

$$\mathbf{V} = x^2 y \mathbf{i} + y^2 z \mathbf{j} - (2xyz + yz^2) \mathbf{k}$$

Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3).

- CO3