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S.E. (Civil) (Part - II) (Semester - III) (Revised) Examination, May - 2016

FLUID MECHANICS - I

Sub. Code : 63341

Day and Date : Tuesday, 03 - 05 - 2016 **Total Marks : 100**

Time : 03.00 p.m. to 06.00 p.m.

Instructions :
1) **Attempt any three questions from each section.**
2) **Figures to the right indicate full marks.**
3) **Assume any other suitable data, if required.**

SECTION - I

Q1) Attempt any four of the following: **[4 × 5 = 20]**

a) Explain : Vapour pressure & cavitation phenomenon.

b) With suitable examples explain the concept of dimensional homogeneity.

c) In case of Froude Model Law, obtain scale ratios for: Velocity, Time, Force, Acceleration and discharge.

d) What are the types of equilibrium and conditions of stability for floating objects?

e) If $u = 6 + 2xy + t^2$, $v = -(xy^2 + 10t)$ and $w = 5$, find the acceleration of particle at (1,0,1) at $t = 1$ sec.

Q2) a) What is Newton law of viscosity? Two large horizontal plane surfaces are 25 mm apart. This space is filled with glycerin. Find what force is required to drag a very thin plate of area 0.6 m^2 between the two surfaces at a speed 0.7 m/sec. if: **[8]**

i) The plate is equidistant from two surfaces &

ii) It is at 10 mm from one of the surfaces.

Dynamic viscosity the glycerin is 8.04 × 10-1 Pa-sec.

b) Define Metacentric height. Explain the experimental method of determining metacentric height. **[7]**

P.T.O.

Q3) a) Using Buckingham's π theorem, show that the velocity through a circular orifice is given by, $V=\sqrt{2gH\phi}\left(\frac{D}{H},\frac{\mu}{\rho VH}\right)$ where H is head causing flow, D is orifice dia., ρ & μ are density & dynamic viscosity of fluid, g is gravitational acceleration. **[8]**

b) An equilateral triangle 2m side is immersed vertically in water with one of its axis of symmetry parallel to water surface and at a depth of 2m below the water surface. Determine total pressure and position of centre of pressure. **[7]**

Q4) a) Derive the continuity equation in differential form for steady incompressible three dimensional flow. **[8]**

b) The velocity components in a 2-D irrational flow of an incompressible fluid are:

$u = y^3/3 + 2x - x^2y$ and $v = xy^2 - 2y - x^3/3$;

Obtain the expressions for stream function and velocity potential. **[7]**

SECTION - II

Q5) Attempt any four of the following: **[4 × 5 = 20]**

a) Briefly explain venturimeter with a neat sketch.

b) Determine the difference in elevation between two water surfaces in two tanks which are connected by a horizontal pipe of diameter 45 cm and length 10 m. The discharge through the pipe is 500 lit/sec. Consider all losses and assume f = 0.035.

c) Calculate the equivalent dia of the following compound pipe line

i) 10 cm diameter, 200 m long ii) 15 cm diameter, 300 m long. Assume of to be same for all pipes.

d) Explain Prandtl mixing length theory.

e) Explain the phenomenon of water hammer in pipes.

Q6) a) State the Bernoullis Theorem and How do you verify Bernoulli's theorem experimentally. **[8]**

b) A cylindrical tank 3m in diameter contains water upto a height of 4 m. Find the time required for water level to fall from 4 m to 2 m through an orifice of 4 cm diameter at the base of the tank. Take Cd for orifice as 0.59. Also find the time required to empty the tank. Prove the formula used. **[7]**

Q7) a) What do you mean by viscous flow? Derive an expression for velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution at a section of the pipe. **[8]**

b) A smooth pipe 5 cm in diameter carries an oil of sp gravity 0.8 at a velocity of 0.25 m/sec. Show that flow will be laminar and calculate the loss of head per 10 m length of the pipe. Take viscosity of oil as 8 poise. **[7]**

Q8) a) Define: nominal thickness of boundary layer and obtain the expressions for displacement thickness of BL and momentum thickness of BL. **[8]**

b) Explain the terms: **[7]**

i) Laminar boundary layer

ii) Turbulent boundary layer

iii) Laminar sub layer