

SL-237

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Seat No.	
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S.E. (Civil) (Semester-III) (Revised)
Examination, May - 2017
FLUID MECHANICS-I
Sub. Code : 63341

Day and Date : Wednesday, 17-05-2017
Time : 2.00 p.m. to 5.00 p.m.

Total Marks : 100

- Instructions :**
- 1) Attempt any three questions from each section.
 - 2) Figures to the right indicate full marks.

SECTION-I

- Q1) a)** Define and give practical example of following properties. Also give their SI units. Explain their significance. [8]
- i) Viscosity
 - ii) Vapour pressure
 - iii) Surface tension and capillary
 - iv) Compressibility– Bulk modulus of elasticity
- b) The pressure drop ΔP in a pipe of diameter D and length L depends on the density ρ , viscosity μ , mean velocity V , average height of roughness k Show that the pressure drop can be expressed as, [8]
- $$\Delta P = \rho V^2 f(L/D, \mu/ \rho VD, k/D)$$
- Q2) a)** Explain how total pressure is determined for a curved surface immersed in liquid? [5]
- b) Find total pressure acting on a dam with vertical u/s face. The depth of water stored is 40m. Consider unit length of dam. Draw a sketch to show pressure distribution. [6]
- c) Explain the procedure of determination of metacentric height of a floating object experimentally. Draw sketch. [5]

P.T.O.

Q3) a) In an incompressible flow, the velocity vector is given by, [8]

$$V = (6xt + yz^2) I + (3t + xy^2) j + (xy - 2xyz - 6tz)k$$

- i) Verify whether the continuity equation is satisfied?
 - ii) Determine the acceleration vector at point (2,2,2) and $t = 2.0$
- b)** Define following terms [8]
- i) Stream function
 - ii) Velocity potential
 - iii) Stream line
 - iv) Streak line

Further explain flownet and its uses.

Q4) Write short notes on any three. [18]

- a) Hydraulic similitude: importance and application.
- b) Pressure measurement devices.
- c) Equilibrium condition for floating and completely submerged objects.
- d) Scale ratios and distorted models.

SECTION-II

Q5) a) Draw a neat sketch of following devices and explain their working. [8]

- i) Venturimeter
- ii) Pitot tube

- b)** A tank of vertical sides and having horizontal base of $3 \times 3 \text{ m}^2$, contains water to a depth of 4m. Water is discharging through an orifice 4 cm diameter provided at the bottom of the tank. Determine the time to drop the level of water by 1m. Take $C_d = 0.62$. [8]

Prove the formula used.

- Q6) a) Derive Hazen-Poiseuille equation for laminar flow and further prove that friction factor $f = 64/R_N$, for laminar flow [8]
- b) The velocity distribution in the boundary layer is given by, [8]
 $u/U = 2(y/\delta) - (y/\delta)^2$, δ is being boundary layer thickness.
 Calculate,
 i) Displacement thickness
 ii) Momentum thickness
 iii) Energy thickness
- Q7) a) What is syphon? Derive an expression for negative pressure at summit. Draw a neat sketch. [8]
- b) What do you mean by compound pipe and equivalent pipe? A compound pipe system consist of 1800 m of 0.5 m diameter , 1200 m of 0.4 m diameter and 600 m of 0.3 m diameter new cast iron pipes connected in series. Convert the system to, [8]
 i) An equivalent length of 0.4 diameter pipe.
 ii) Equivalent size pipe 3600 m long.
- Q8) Write short notes on any three. [18]
- Hydraulic coefficient of orifice.
 - Moody's chart.
 - Separation of boundary layer: Reasons and methods of control.
 - Water hammer causes, effect and control.
 - Prandlt mixing length theory.

