

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-III (OLD) EXAMINATION – WINTER 2018****Subject Code:130101****Date:22/11/2018****Subject Name:Fluid Mechanics****Time:10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) State and explain Pascal's law. **07**  
(b) What is capillary effect? Derive equation for capillary rise and fall. **07**
- Q.2** (a) What is meta-centric height? Derive an expression for meta-centric height of a floating body. **07**  
(b) A circular plate of diameter 1m is immersed in a liquid of specific gravity 0.85 with its plane making an angle of  $35^\circ$  with the horizontal. The centre of the plate is at a depth of 2.5 m below the free surface. Calculate (i) total pressure force on one side of the plate, and (ii) location of the centre of pressure. **07**
- OR**
- (b) Define total hydrostatic force and centre of pressure. Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and locate the position of centre of pressure. **07**
- Q.3** (a) Describe the Buckingham's  $\pi$  method for dimensional analysis **07**  
(b) The efficiency  $\eta$  of a fan depends on the density  $\rho$ , the dynamic viscosity  $\mu$  of the fluid, the angular velocity  $\omega$ , diameter  $D$  of the rotor and discharge  $Q$ . Express  $\eta$  in terms of dimensionless parameters. **07**
- OR**
- Q.3** (a) Prove that in a 2-D fluid flow the stream lines are always perpendicular to equipotential lines. **07**  
(b) A fluid flow field is given by  $V = x^2yi + y^2zj - (2xyz + yz^2)k$ , show that it is case of possible steady incompressible fluid flow, calculate resultant velocity at point (2,1,3) **07**
- Q.4** (a) Derive an expression for the discharge of water over the V notch with usual notation **07**  
(b) A horizontal Venturimeter 60 cm x 30 cm is used to measure the water flow through a pipe. The head causing the flow is measured as 14 cm of Hg by mercury U tube manometer. Find the flow rate in liters/min. Take  $C_d = 0.95$  **07**
- OR**
- Q.4** (a) Explain rotational and irrotational flow with neat sketches. **07**  
(b) A pipe A 350 mm in diameter, branches into two pipes (B and C) of diameters 200 mm and 150 mm respectively. If the average velocity in pipe A is 2.5 m/s, determine (i) Discharge through pipe A, and (ii) velocity in pipe C if the average velocity in pipe B is 1.5 m/s. **07**
- Q.5** (a) Explain various flow losses in pipes. **07**  
(b) Derive Darcy Weisbach equation for the co-efficient of friction in pipes **07**
- OR**
- Q.5** (a) Explain the nature of propagation of disturbance in compressible flow when mach number less than one, is equal to one and is more than one. **07**  
(b) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. **07**

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