

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019****Subject Code: 2141906****Date: 12/12/2019****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) Define terms: Viscosity, Specific gravity, Surface tension **03**
  - (b) State and prove pascal's law with usual notations **04**
  - (c) Explain with neat diagram construction and working of bourdon tube pressure gauge. **07**
- Q.2**
- (a) What is compressibility? Derive an expression for it. **03**
  - (b) Define the terms Total pressure, Centre of pressure, Buoyancy. Centre of , Buoyancy **04**
  - (c) Show that the distance between the meta-centre and centre of buoyancy is given by  $BM = \frac{I}{V}$  **07**
- OR**
- (c) A solid cylinder of diameter 4 m has a height of 4 m. Find the metacentric height of the cylinder if the specific gravity of the material of cylinder is 0.7 and it is floating in water with its axis vertical. State whether the equilibrium stable or unstable. **07**
- Q.3**
- (a) Explain : (i) Steady flow and unsteady flow (ii) Laminar and turbulent flow **03**
  - (b) The diameter of pipe at section 1 & 2 are 10 cm and 15 cm respectively. The discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s . Determine also the velocity at section 2. **04**
  - (c) Explain the construction and working of a Venturimeter and also derive an expression for the discharge through it. **07**
- OR**
- Q.3**
- (a) Discuss stability of submerged and floating bodies **03**
  - (b) Explain the following terms **04**  
(i) Hydraulic grade line (ii) Total Energy Line
  - (c) Derive Darcy-Weisbach equation for head loss due to friction in pipe flow. **07**
- OR**
- Q.4**
- (a) Differentiate between streamline and expotential line **03**
  - (b) Explain Flow-net and state the importance of flow net **04**
  - (c) If for two dimensional potential flow , the velocity potential is given by  $\phi = x(2y-1)$  . determine the velocity component at point (4 , 5 ).Determine the value of stream function  $\psi$  at point P. **07**
- OR**
- Q.4**
- (a) Write short note on Say bolt Viscometer. **03**
  - (b) Discuss different types of similarities that must exist between a prototype and its model. **04**

- (c) The frictional torque  $T$  of a disc of diameter  $D$  rotating at a speed  $N$  in a fluid of viscosity  $\mu$  and density  $\rho$  in a turbulent flow is given by  $T = D^5 N^2 \rho \Phi\left[\frac{\mu}{D^2 N \rho}\right]$  07

Prove this by Buckingham's  $\pi$  method

- Q.5** (a) Prove the velocity of a sound wave in a compressible fluid is given by  $C = \sqrt{\gamma RT}$ . 03  
 (b) Explain propagation of sound waves for Sub sonic and Sonic flow. 04  
 (c) Derive an expression for Hagen-Poiseuille's formula for viscous flow. 07

**OR**

- Q.5** (a) Derive an expression of capillary rise (depression) between two vertical parallel surfaces. 03  
 (b) Derive an expression for discharge over rectangular notch 04  
 (c) Define Reynold's stress. Explain Prandtl's mixing length theory for total shear stress in turbulent flow. 07

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