

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (OLD) EXAMINATION – WINTER 2018****Subject Code:130602****Date:28/11/2018****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) Derive Darcy-Weisbach equation for friction loss in the pipe. **07**
(b) Explain with sketch the relationship between the absolute pressure, atmospheric pressure and gauge pressure. **07**

- Q.2** (a) State and prove Pascal's law **07**
(b) What is metacentre? Explain how metacentric height is determined analytically. **07**

OR

- (b) Define surface tension. Prove the relationship between surface tension and pressure inside a droplet of liquid in excess of outside pressure is given by $P = 4\sigma/d$ **07**

- Q.3** (a) Derive an expression for the total pressure and position of centre of pressure on a plane surface immersed vertically in a liquid. **07**
(b) A 1m wide and 3m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 40° with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 2m below the free water surface. **07**

OR

- Q.3** (a) Explain Bernoulli's equation. What are the practical applications of Bernoulli's equation? **07**
(b) The velocity potential function is given by $\phi = 3(x^2 - y^2)$. Calculate the velocity components at the point (2,1). **07**

- Q.4** (a) Derive the continuity equation for three dimensional flow. **07**
(b) A horizontal venturimeter with inlet and throat diameters 15 cm and 7.5 cm respectively is used to measure the flow of water. The readings of differential manometer connected to the inlet and throat is 30cm of mercury. Determine the discharge. Take $C_d = 0.98$. **07**

OR

- Q.4** (a) Explain velocity potential and stream functions. Show that streamlines and equipotential lines intersect orthogonally. **07**
(b) Define Hydraulic co-efficient. Derive equation $C_c = C_d / C_v$ **07**

- Q.5** (a) Classify different types of orifices according to its shapes, size, discharge condition and shape of upstream edge. Explain all in brief. **07**
(b) Derive an equation for the discharge passing over a rectangular notch and show that percentage error in estimation of discharge is 1.5 times the percentage error in head measurement **07**

OR

- Q.5** (a) Explain the following terms: (i) Subsonic flow (ii) Sonic flow (iii) Super sonic flow and (iv) Mach cone **07**
(b) What do you understand by stagnation pressure? Obtain an expression for stagnation pressure of a compressible fluid in terms of approaching Mach number and pressure. **07**
