

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – SUMMER 2013****Subject Code: 130602****Date: 28-05-2014****Subject Name: Fluid Mechanics****Time: 02.30 pm - 05.00 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 and explain following fluid properties. **07**
(1) Surface tension
(2) Dynamic viscosity
(3) Capillarity
- (b)** What is the use of manometer? Prove that intensity of pressure at any point in a fluid at rest has same magnitude in all directions. **07**
- Q.2 (a)** State Bernoulli's equation for compressible flow. Derive Bernoulli's equation for adiabatic process. **07**
- (b)** A circular plate 3.5 m diameter is immersed in water in such a way that its greatest and least depth below free surface is 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of the center of pressure. **07**
- OR**
- (b)** Define force of buoyancy and meta-centre. Discuss the conditions of equilibrium for floating and sub-merged bodies with neat sketches. **07**
- Q.3 (a)** (i) A stream function in a two dimensional flow is $\psi = 4xy$. Calculate the velocity at the point (4, 3). Find the corresponding velocity potential ϕ . **04**
- (ii) State Bernoulli's equation for steady incompressible fluid flow. What assumptions are made in its derivation? **03**
- (b)** What is venturimeter? Derive an expression for discharge through a venturimeter. **07**
- OR**
- Q.3 (a)** (i) Define the terms : Stream line , Equipotential line , Flownet **03**
- (ii) What is pitot tube? How velocity at any point is determined by pitot tube? **04**
- (b)** A horizontal venturimeter with inlet diameter 30 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 50 liters/s. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$. **07**
- Q.4 (a)** What are major and minor energy losses in pipes? Derive an expression for loss of head due to sudden enlargement and sudden contraction of pipe. **07**
- (b)** (i) Explain hydraulic gradient line and total energy line **03**
- (ii) Classify orifices and mouthpieces based on their shape, size and sharpness. **04**

OR

Q.4 (a) A horizontal pipe of diameter 450 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in larger and smaller pipe are given as 14.5 N/cm² and 12.5 N/cm² respectively. If $C_c = 0.62$. Find loss of head due to contraction and discharge of water. **07**

(b) (i) What do you understand by pipes in series and pipes in parallel? **04**

(ii) Define: Co-efficient of velocity, Co-efficient of discharge, Vena-contracta. **03**

Q.5 (a) Derive an expression for discharge through fully submerged and partially submerged orifice. **07**

(b) Water is flowing in a rectangular channel of 1.5 m wide and 0.75 m deep. Find discharge over a rectangular weir of crest length 65 cm, if head of water over the crest of weir is 25 cm and water flow over the weir. Take $C_d = 0.62$. Take approach velocity into consideration. **07**

OR

Q.5 (a) (i) What is orifice and mouthpiece? What is its use? **02**

(ii) A circular tank of diameter 3 m contains water up to height of 4 m. The tank is provided with an orifice of diameter 0.4 m at the bottom. Find time taken by water to fall from 4.0 m to 1.0 m and for completely emptying the tank. Take $C_d = 0.98$. **05**

(b) Prove that the discharge through a triangular notch or weir is **07**

$$Q = \frac{8}{15} \times C_d \times \tan \frac{\theta}{2} \times \sqrt{2g} H^{5/2}$$
