

**GUJARAT TECHNOLOGICAL UNIVERSITY****B.E. Sem-III Remedial Examination March 2010****Subject code: 130602****Subject Name: Fluid Mechanics****Date: 11 / 03 / 2010****Time: 11.00 am – 01.30 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)** Explain the meaning of specific weight, mass density and specific gravity. The weight of  $5\text{m}^3$  of a certain oil is 45kN. Calculate its specific weight, mass density and specific gravity. **07**

**(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.2 (a)** State and prove Pascal's law. **07**

**(b)** Derive an expression for the total pressure and position of centre of pressure on a plane surface immersed vertically in a liquid. **07**

**OR**

**(b)** A solid cylinder of diameter 4.5m has a height of 3.5m. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder 0.6 **07**

**Q.3 (a)** Define and distinguish between (i) Laminar and Turbulent flow, (ii) Uniform and Non-Uniform flow and (iii) Steady and Unsteady flow.. **07**

**(b)** What is Euler's equation of motion? How will you obtain Bernoulli's equation from it? **07**

**OR**

**Q.3 (a)** What is manometer? Describe a differential manometer with sketch? **07**

**(b)** A pipe through which water is flowing having diameter 40cm and 20cm at the cross section 1 and 2 respectively. The velocity of water at section 1 is given 5.0m/s. Find the velocity head at section 1 and 2 and also rate of discharge. **07**

**Q.4 (a)** What are the hydraulic coefficients? Name them and derive the equation  $C_c = C_d / C_v$ . **07**

**(b)** Determine the height of a rectangular weir of length 5m to be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.5m and discharge is  $1.5\text{m}^3/\text{sec}$ . Take  $C_d = 0.6$  and neglect end contractions. **07**

**OR**

**Q.4 (a)** Define and explain the terms (i) Total energy line and (ii) Hydraulic gradient line. **07**

**(b)** Two tanks are connected with the help of two pipes in series. The lengths of the pipes are 1000m and 800m whereas the diameters are 400mm and 200mm respectively. The coefficient of friction for both the pipes is 0.008. The difference of water level in the two tanks is 15m. Find the rate of flow of water through the pipes, considering all losses. **07**

- Q.5 (a)** Prove that the discharge through a triangular notch or weir is given by  $Q = \frac{8}{5} C_d \tan \frac{\theta}{2} (2g)^{1/2} H^{3/2}$  **07**
- (b)** State the Bernoulli's theorem for compressible flow and derive Bernoulli's equation when process is isothermal. **07**

**OR**

- Q.5 (a)** Explain velocity potential and stream functions. Show that streamlines and equipotential lines intersect orthogonally. **07**
- (b)** Explain the terms: (i) Local acceleration and (ii) Convective acceleration. Two velocity components are given and from that determine third component of velocity such that they satisfy the continuity equation. **07**
- $v = 2y^2$  ;  $w = 2xyz$

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A pipe line AB of diameter 400mm and of length 500m carries water at the rate of 60liters/sec. The flow takes place from A to B where point B is 35m above A. Find the pressure at A if the pressure at B is  $19.75 \text{ N/cm}^2$ .  
Take  $f = 0.008$