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10ME36B/10AU36B

Third Semester B.E. Degree Examination, June/July 2015
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Differentiate the following : i) Liquids & gases ii) Pseudoplastic and Dilatant fluids. **(04 Marks)**

b. Derive the expression for surface tension of hollow bubble and liquid jet. **(06 Marks)**

c. Vertical gap 2.2cm wide of infinite extent contains a fluid of viscosity 2.0NS/m^2 and specific gravity 0.9. A thin metallic plate 1.2m × 1.2m × 0.2cm is to be lifted up with a velocity of 0.15m/sec through the gap. If the plate is in the middle of the gap, find the force required to lift the plate. Weight of the plate is 40N. **(10 Marks)**

2 a. Convert 1 kgf/cm^2 pressure in terms of : i) meters of water ii) mm of mercury. **(04 Marks)**

b. With neat sketch, explain working of single column manometer. **(06 Marks)**

c. A circular plate 3.0m diameter having concentric circular hole of diameter 1.5m is immersed in water such a way that its greatest and least depths from free surface are 4m and 1.5m respectively. Determine total pressure on one face of the plate and the position of centre of pressure. **(10 Marks)**

3 a. Explain briefly : i) Steady and Unsteady flow ii) Uniform and Non uniform flow. **(04 Marks)**

b. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$, determine value of stream function Ψ at that point. **(06 Marks)**

c. Derive expression for metacentric height for a floating body in liquid. **(10 Marks)**

4 a. Derive Euler's equation of motion. Obtain Bernoulli's equation from Euler's equation of motion. State the assumptions made. **(10 Marks)**

b. A pump has a tapering pipe running full of water. The pipe is placed vertically with the diameter at the base and top being 1.2m and 0.6m respectively. The pressure at the upper end is 240mm of mercury (vacuum). The pressure at the upper end is 15kN/m^2. Assume loss of head to be 20% difference in velocity head. Calculate the discharge when flow is vertically upwards and difference in elevation is 3.9m. **(10 Marks)**

PART – B

5 a. Derive expression for actual discharge through orifice meter. Explain how orifice meter is different from venturimeter. **(10 Marks)**

b. In a fuel injection system, small droplets are formed by break up of liquid jet. Assume the droplet diameter 'd' is function of liquid density ρ, viscosity μ, surface tension σ, nozzle diameter D and jet velocity V. Show using Buckingham's π – theorem $\frac{d}{D} = \phi\left[\frac{\rho VD}{\mu}, \frac{\sigma}{\mu V}\right]$

Considering (D, V, μ) are repeating variables. **(10 Marks)**