

SE. Civil Sem III (CBCGS)

Fluid Mechanics - I



QP Code : 27402

19 DEC 2011

(3 hours)

Note:

Max. Marks: 80

Question no.1 is compulsory

Solve any 3 questions out of remaining

Assume data wherever necessary and clearly mention the assumptions made.

Draw neat figures as required.

1. Answer any 4 of the following. 20
 - a. Write Euler's equation of motion along a stream line and integrate it to obtain Bernoulli's equation and list the assumptions made.
 - b. Explain Surface tension & obtain the expression between surface tension and pressure inside the liquid droplet in excess of outside pressure.
 - c. Find the gauge pressure and absolute pressure in N/m^2 at a point 4 m below the free surface of a liquid of sp. gr. 1.2, if atmospheric pressure is equivalent to 750 mm of mercury.
 - d. Explain Flow past a Rankine Oval Body.
 - e. Derive the expression for discharge over a rectangular weir in terms of head of water over the crest of the weir.
2. a. The following data relates to venturimeter fitted to an inclined pipe in which water is flowing. Diameter of the pipe = 300 mm; Throat diameter = 150 mm; Specific gravity of liquid used in U tube manometer = 0.8; Reading of manometer = 400 mm; Loss of head between the inlet and throat = $0.3 \times$ kinetic head of the pipe. Find the discharge. 10
 - b. Derive the expression for Metacentric Height. 10
3. a. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$; determine the velocity at the point (4, 5). Determine also the value of stream function at that point? 10
 - b. A circular plate of 1m diameter is immersed in water in such a way that its plane makes an angle of 30° with the horizontal and its top edge is 1.25 m below the water surface. Find the total pressure on the plate and the point where it acts. 10

[TURN OVER]

4. a. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of shaft is 0.5 m and it rotates at 200 rpm. Calculate the power lost in the oil for a sleeve length of 100 mm. The thickness of the oil film is 1.0m. 10
- b. A convergent-divergent mouthpiece is fitted into the vertical side of a tank containing water. Assuming that there are no losses in the convergent part of the mouthpiece, and that the losses in the divergent part are equivalent to 0.2 times the velocity head at exit and that the maximum absolute pressure head at the throat is 2.44m of water for a barometric pressure of 760 mm of mercury, determine the throat and exit diameters of the mouthpiece when the discharge is 4.25 lit/sec, for a head of 1.52 m. 10
5. a. A cylindrical vessel 15 cm in diameter and 40 cm long is completely filled with water. The vessel is open at the top. Find the quantity of water left in the vessel, when it is rotated about the vertical axis with a speed of 300 rpm. 10
- b. Explain Rotameter and Pitot tube. 05
- c. Show that the error of 1% in measuring H (height of liquid surface above the sill of notch or weir) will produce 1.5% error in discharge over a rectangular notch or weir. 05
6. a. A U-tube differential manometer connects two pressure pipes A and B. pipe A contains Carbon tetra chloride having a specific gravity 1.594 under a pressure of 11.772 N/cm² and pipe B contains oil of specific gravity 0.8 under a pressure of 11.772 N/cm². The pipe A lies 2.5m above pipe B. find the difference of pressure measured by mercury as fluid filling U-tube. 10
- b. Derive the expression for maximum discharge over broad crested weir. 10