

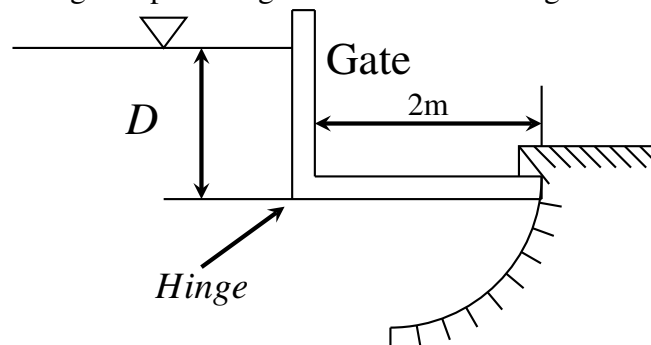
# 2011-XE

EE24BTECH11020 - Ellanti Rohith

- 1) A certain fluid flow is influenced by density  $\rho$ , angular velocity  $\omega$ , dynamic viscosity  $\mu$ , and a characteristic length  $L$ . A relevant non-dimensional parameter will be [GATE 2011]
  - a)  $\rho\omega\mu/L^2$
  - b)  $\rho\omega L^2/\mu$
  - c)  $\rho\mu L^2$
  - d)  $\rho\omega\mu L$
- 2) The drags due to potential flow past a cylinder of diameter  $D$  cm and a slender airfoil of chord length  $D$  cm are compared. Assuming unit depth for both bodies, which one of the following would be **TRUE**? [GATE 2011]
  - a) The drag on the cylinder is greater
  - b) The drag on the airfoil is greater
  - c) Both the drags are equal
  - d) Additional data is needed to compare the drags
- 3) For a fully developed flow between two parallel flat plates, the velocity gradient at a point is found to be  $1000 \text{ s}^{-1}$ . If the density of the fluid is  $880 \text{ kg/m}^3$  and the kinematic viscosity of the fluid is  $7.4 \times 10^{-7} \text{ m}^2/\text{s}$ , the shear stress at the same point is approximately [GATE 2011]
  - a) 0 Pa
  - b) 1.30 Pa
  - c) 0.32 Pa
  - d) 0.65 Pa
- 4) An open channel flow is to be simulated in the laboratory. For this purpose, a 1:25 scale model is constructed. If the flow velocity in the prototype is 5 m/s, for dynamic similarity the model should have a flow velocity of [GATE 2011]
  - a) 5 m/s
  - b) 1 m/s
  - c) 125 m/s
  - d) 25 m/s

**Q.10 - Q.22 carry two marks each.**

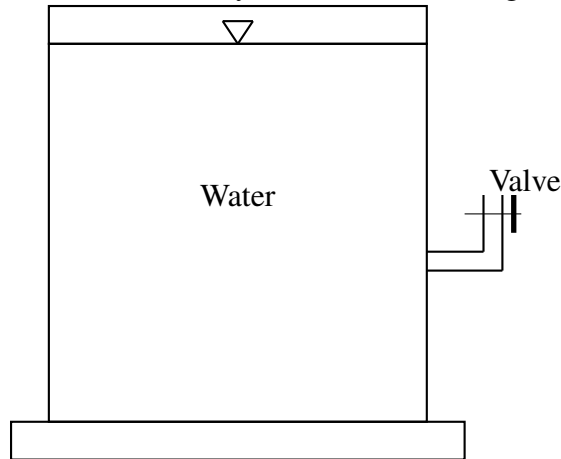
- 5) A pitot-static probe is inserted in an air flow. A manometer connected to this probe having Hg as the manometric fluid shows a difference of 30 mm. Assume a probe factor of 1. Assuming  $\rho_{\text{air}} = 1.23 \text{ kg/m}^3$ ,  $\rho_{\text{Hg}} = 13600 \text{ kg/m}^3$  and  $g = 10 \text{ m/s}^2$ , the speed of the air flow is approximately [GATE 2011]
  - a) 66.5 m/s
  - b) 76.5 m/s
  - c) 81.5 m/s
  - d) 92.5 m/s
- 6) Consider an L-shaped gate with water level above the hinge as shown. At approximately what height  $D$  of the water level will the gate open? Neglect the mass of the gate. Assume  $g = 10 \text{ m/s}^2$ .



[GATE 2011]

- a) 3.46 m                      b) 4.36 m                      c) 6.43 m                      d) 5.36 m

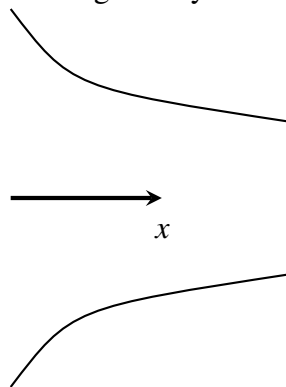
- 7) When a large tank containing water is placed on a weighing scale, a reading of 10000 N is obtained. The tank is fitted with an outlet pipe and a valve as shown. When the valve is opened, a jet of water with a velocity of 10 m/s issues out in the vertically upward direction. The diameter of the outlet pipe is 10 cm. Determine approximately the reading on the weighing scale at the instant the valve is opened and the water jet issues out. Density of water is  $1000 \text{ kg/m}^3$ .



[GATE 2011]

- a) 9215 N                      b) 10000 N                      c) 10785 N                      d) 12500 N

- 8) A fluid with a volumetric flow rate of  $5 \text{ m}^3/\text{s}$  enters the nozzle shown below. The cross-sectional area varies with  $x$  as  $A(x) = \frac{1}{(1+x^2)}$ . Assuming that the flow is parallel and uniform at each cross-section, the acceleration at any point in the nozzle is given by



[GATE 2011]

- a)  $50(x + x^3)$                       b)  $50(1 + x^2)$                       c) 0                      d)  $50(x^2 + x^3)$

- 9) Consider fully developed flow of water in a pipe of diameter 2 cm. The average velocity of the flow is 2 m/s. The viscosity of the water is  $10^{-3} \text{ kg/m}\cdot\text{s}$  and the density is  $1000 \text{ kg/m}^3$ . The friction factor can be calculated using  $f = 64/\text{Re}$  for laminar flows and  $f = 0.3164/\text{Re}^{0.25}$  for turbulent flows. The pressure drop over a length of 0.5 m is

[GATE 2011]

- a) 0.08 Pa                      b) 325 Pa                      c) 1115 Pa                      d) 9875 Pa

- 10) Consider a steady, fully developed flow in a horizontal pipe of diameter  $D$ . Over a section of length  $L$  of this pipe, a pressure drop of  $\Delta p$  is observed. The average wall shear stress over this section is

[GATE 2011]

