



**Sample Question Paper for Fluid Mechanics-I**

**Q1. Solve all questions mandatory**

**02 marks each**

1. a) The specific gravity of a liquid has  
I) the same unit as that of mass density  
II) the same unit as that of weight density  
III) the same unit as that of specific volume  
IV) no unit

1.b) The specific volume of a liquid is the reciprocal of  
I) weight density  
II) mass density  
III) specific weight  
IV) specific volume

1.c) A beaker is filled with a liquid up to the mark of one liter and weighed. The weight of the liquid is found to be 6.5 N. The specific weight of the liquid will be  
I) 6:5 kn/m<sup>3</sup>  
II) 6:6 kn/m<sup>3</sup>  
III) 6:7 kn/m<sup>3</sup>  
IV) 6:8 kn/m<sup>3</sup>

1.d) A beaker is filled with a liquid up to the mark of one litre and weighed. The weight of the liquid is found to be 6.5 N. The specific gravity of the liquid will be  
I) 0.65  
II) 0.66  
III) 0.67  
IV) 0.68

1.e) If there is bucket full of oil and bucket full of water and you are asked to lift them, which one of the two will require more effort given that volume of buckets remains same?  
I) Oil bucket  
II) Water bucket  
III) Equal effort will be required to lift both of them  
IV) None of the mentioned

1.f) If the fluid has specific weight of 10N/m<sup>3</sup> for a volume of 100dm<sup>3</sup> on a planet which is having acceleration due to gravity 20m/s<sup>2</sup>, what will be its specific weight on a planet having acceleration due to gravity 4m/s<sup>2</sup>?  
I) 5 N/m<sup>3</sup>  
II) 50 N/m<sup>3</sup>  
III) 2 N/m<sup>3</sup>  
IV) 10 N/m<sup>3</sup>

1.g) A stone weighed 177 N on earth. It was dropped in to oil of specific gravity 0.8 on a planet whose acceleration due to gravity is 5m/s<sup>2</sup>. It displaced oil having weight of 100N. What was the volume of oil displaced by the stone?  
I) 25 liters  
II) 15 liters  
III) 30 liters  
IV) 35 liters

1.h)The viscosity of a fluid in motion is 1 Poise. What will be it's viscosity (in Poise) when the fluid is at rest?  
I) 0  
II) 0.5  
III) 1

IV) 2

1.i) Which of the following correctly states how the viscosities of a liquid and a gas will change with temperature?

I) Viscosity increases with the increase in temperature of a liquid and decreases with the increase in temperature of a gas

II) Viscosity increases with the increase in temperature of a liquid and increases with the increase in temperature of a gas

III) Viscosity decreases with the increase in temperature of a liquid and decreases with the increase in temperature of a gas

IV) Viscosity decreases with the increase in temperature of a liquid and increases with the increase in temperature of a gas

1.j) The dynamic viscosity of a fluid is 1 Poise. What should one multiply to it to get the answer in N-s/m<sup>2</sup>?

I) 0.1

II) 1

III) 10

IV) 100

1.k) Two horizontal plates placed 250mm have an oil of viscosity 20 poises. Calculate the shear stress in oil if upper plate is moved with velocity of 1250mm/s.

I) 20 N/m<sup>2</sup>

II) 2 N/m<sup>2</sup>

III) 10 N/m<sup>2</sup>

IV) None of the mentioned

1.l) In liquids in order to measure the viscosity of fluid experimentally we consider the variation of shear stress with respect to what property?

I) strain

II) shear strain

III) rate of shear strain

IV) none of the mentioned

1.m) Which one of the following is the correct relation between compressibility  $\beta$  and Bulk Modulus  $k$

I)  $\beta = k$

II)  $\beta = 1/k$

III)  $\beta = 2k$

IV)  $\beta = k/2$

1.n) Which of the following contribute to the reason behind the origin of surface tension?

I) only cohesive forces

II) only adhesive forces

III) neither cohesive forces nor adhesive forces

IV) both cohesive forces and adhesive forces

1.o) A soap bubble of  $d$  mm diameter is observed inside a bucket of water. If the pressure inside the bubble is 0.075 N/cm<sup>2</sup>, what will be the value of  $d$ ? (Take surface tension as 0.075 N/m)

I) 0.4

II) 0.8

III) 1.6

IV) 4

1.p) If a glass tube of 10 mm diameter is immersed in water, what will be the rise or fall in capillary? (Take surface tension = 0.075 N/m,  $g = 10$  m/s<sup>2</sup> and angle of contact = 0)

I) 0.75

II) 1.5

III) 3

IV) 6

1.q) Determine the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is restricted to 5mm. Consider surface tension of water in contact with air as 0.073 N/m

I) 5.95mm

II) 11.9mm

III) 2.97mm

IV) 4.46mm

1.r) Will capillary rise occur and if it occurs what will be capillary rise if glass capillarity tube is immersed in water and experiment is carried out by astronauts in space.

I) Capillarity rise will not occur

II) Capillarity rise will occur infinitely and will come out in form of fountain

III) Capillarity rise will occur finitely and will be the whole length of tube

IV) None of the mentioned

1.s) A Hydraulic press has a ram of 30 cm diameter and a plunger of of 2 cm diameter. It is used for lifting a weight of 35 kN. Find the force required at the plunger.

I) 233.3 kn

II) 311.1 kn

III) 466.6 kn

IV) 155.5 kn

1.t) In the inverted U-tube Differential manometer, how is the specific gravity of manometric fluid used relative to the fluid flowing in the pipes

a) Specific gravity is more than that of fluid flowing in pipes

b) Specific gravity is less than that of fluid flowing in pipes

c) Specific gravity is equal to that of fluid flowing in pipes

d) None of the mentione

**Q2 Solve any two**

**10 marks each**

Q2.a A rectangular pontoon 8m long, 7m broad and 3m deep weighs 588.6KN. It carries on its upper deck an empty boiler of 4m diameter weighing 392.KN. The center of gravity of the Boiler and pontoon are at their respective centers along a vertical line. Find the metacentric height. Weight density of sea water is  $10104\text{N/m}^3$ .

Q2.b State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation.

Q2.c Water is flowing in a rectangular channel of 1.2m wide and 0.8m deep. Find the discharge over rectangular weir of crest length 70cm if the head of water over the crest of weir is 25cm and water from channel flows over the weir. Take  $C_d = 0.60$ . Neglect end contractions velocity of approach.

**Q3 Solve any four**

**05 marks each**

Q3.a Define mach number. What is the significance of it in compressible fluid flow.

Q3.b State & prove Pascal's Law.

Q3.c A circular plate of 1m diameter is immersed in water in such a way that its plane makes an angle of  $30^\circ$  with the horizontal and its top edge is 1.25m below the water surface. Find the total pressure on the plate and the point where it acts.

Q3.d If for a two dimensional potential flow, the velocity potential is given by:  $\Phi = 4x(3y - 4)$ , determine the velocity at the point (2,3). Determine also the value of stream function  $\Psi$  at the point (2,3).

Q3.e Describe experimental determination of hydraulic coefficients.