

# Vidyalankar

S.Y. Diploma : Sem. IV [ME/MH/MI/PG/PT/FE/FG]

## Fluid Mechanics and Machinery

Time: 3 Hrs.]

Prelim Question Paper

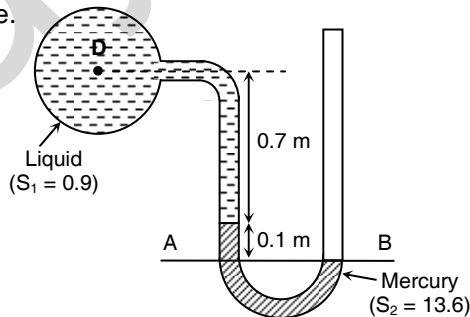
[Marks : 100

- Instructions :**
- (1) All questions are compulsory.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data if necessary.
  - (5) Use of Non-programmable Electronic Pocket Calculator is Permissible.

1. (a) Attempt any **SIX** of the following: [12]
- (i) Define : (1) Newtonian Fluid and (2) Non-Newtonian Fluid
  - (ii) Define capillarity with formula.
  - (iii) What is gauge pressure and absolute pressure?
  - (iv) Define Laminar Flow and Turbulent Flow.
  - (v) Define the terms : (1) Penstocks, (2) Fore bay.
  - (vi) What is impulse turbine and reaction turbine?
  - (vii) Define : (1) Delivery Head ( $h_d$ ), (2) Static head ( $H_s$ )
  - (viii) Give any four hydraulic losses.

- (b) Attempt any **TWO** of the following: [8]
- (i) Explain the terms : (1) Surface tension  
(2) Vapour Pressure
  - (ii) Give detail classification and explain the types with figure of Manometer.
  - (iii) Explain Venturimeter and derive equation for its charge.

2. Attempt any **FOUR** of the following: [16]
- (a) Explain Pitot tube.
  - (b) Find the kinematic viscosity of an oil having density  $980 \text{ kg/m}^3$ . when at a certain point in the oil, the shear stress is  $0.25 \text{ N/m}^2$  and velocity gradient is  $0.3 \text{ /sec}$ .
  - (c) Find the vacuum pressure in a pipe containing a liquid of specific gravity 0.9 as shown in figure.



- (d) Determine the total pressure on a circular plate of diameter 1.5 m, which is placed vertically in water in such a way that the centre of plate is 3 m below the free surface of water. Find centre of pressure also.
- (e) State the Bernoulli's theorem. Explain meaning of each term in it.

- (f) A multistage building is 330 m above the street. If the pressure of 170 kPa is required in a water pipe line at the top of the buildings, what is the pressure of the basement of the building 9 m below street?

3. Attempt any **FOUR** of the following:

[16]

- (a) Obtain the condition for maximum transmission of power through the pipe.
- (b) Explain the concept of hydraulic gradient line and total energy line.
- (c) Pipe diameter 25 cm is suddenly enlarged to diameter of 50 cm, if pipe carries 350 lit/s, find loss of head due to expansion.
- (d) Draw a neat sketch of impact of jet on a fixed vertical plate and write the formula to determine force exerted by jet.
- (e) A jet of water 50 mm in diameter is discharging under a constant head of 70 meters. Find the force exerted by the jet on a fixed plate take coefficient of velocity as 0.9
- (f) A jet of water 50 mm in diameter, moving with a velocity of 15 m/s impinges on a series of vanes moving with a velocity of 6 m/s. Find (1) Force exerted by the jet, (2) Work done by the jet and (3) Efficiency of jet.

4. Attempt any **TWO** of the following:

[16]

- (a) Explain with neat sketch, governing of pelton wheel turbine.
- (b) Draw the inlet and outlet velocity triangle for the buckets in Pelton wheel with the meaning of each term.
- (c) A turbine is to operate under a head of 25 cm at 200 rpm. The discharge is  $9 \text{ m}^3/\text{s}$ , if efficiency is 90%, calculate power developed. Also calculate power generated by a turbine, specific speed of the turbine and performance of turbine under a head of 20 m. Also state the type of turbine.

5. Attempt any **FOUR** of the following:

[16]

- (a) Explain the construction and working of a Kaplan turbine.
- (b) State the functions of draft tube in reaction turbine.
- (c) Define cavitation in turbines, also state effects of cavitation.
- (d) Explain the different types of casing for a centrifugal pump.
- (e) What is difference between single stage and multistage pumps?
- (f) Define the term "Negative slip". Why it takes place in case of a Reciprocating pump?

6. Attempt any **TWO** of the following:

[16]

- (a) Why air vessel is required for reciprocating pumps (with neat sketch and working)?
- (b) A centrifugal pump has a impeller with outer diameter of 70 cm and inner diameter of 35 cm. Angles of vane at inlet and outlet are  $40^\circ$  and  $25^\circ$  respectively. The width at the inlet is 7 cm and outlet 3 cm. Pump runs at 1440 rpm. Assume radial entry at inlet of the pump and vanes bent backwards, calculate discharge power required to drive the pump.
- (c) What are the different types of draft tubes? Explain any one with neat sketch.

