

B.TECH
(SEM III) THEORY EXAMINATION 2022-23
FLUID MECHANICS AND FLUID MACHINES

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

- (a) How does the dynamic viscosity of (a) liquids, (b) gases vary with temperature?
- (b) Differentiate between mass density and specific volume.
- (c) Describe laminar and turbulent flow.
- (d) Differentiate between steady flow and unsteady flow.
- (e) Discuss the Reynold's number and its applications.
- (f) Explain water Hammer in brief.
- (g) Describe the difference between impulse and reaction turbine.
- (h) Explain Specific Speed of a turbine.
- (i) Describe slip of reciprocating pump.
- (j) What is cavitation.

SECTION B**2. Attempt any three of the following: 10x3=30**

- (a) Illustrate:
 - (i) Newton's Law of Viscosity.
 - (ii) Capillarity.
 - (iii) Difference between Notches and Weirs
- (b) Define the following:
 - (i) Uniform and Non Uniform Flow.
 - (ii) 1D,2D,3D flows
 - (iii) Compressible vs Incompressible flows
- (c) Illustrate the separation of boundary layer and the methods to prevent it.
- (d) Derive the expression of hydraulic efficiency of Pelton turbine.
- (e) Illustrate the following .
 - (i) Derivation of Specific speed of centrifugal pump
 - (ii) Working and construction of centrifugal pump

SECTION C**3. Attempt any one part of the following: 10x1=10**

- (a) Calculate the capillary effect in millimetres in a glass tube of 4 mm diameter, when immersed in
 - (i) water, and
 - (ii) mercury.
 The temperature of the liquid is 200°C and the values of the surface tension of water and mercury at 200°C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130°. Take density of water at 200°C as equal to 998 kg/m³.
- (b) Illustrate the derivation to calculate the discharge through a venturimeter.

4. Attempt any one part of the following: 10x1=10

- (a) Illustrate velocity potential and stream function. Show that 3 D continuity equation for 3 D flow in Cartesian coordinates is given by

$$\frac{\partial \rho}{\partial t} + \frac{\partial(\rho u)}{\partial x} + \frac{\partial(\rho v)}{\partial y} + \frac{\partial(\rho w)}{\partial z} = 0$$

- (b) Illustrate the properties of velocity potential function and stream function. A streamfunction is given by $(x^2 - y^2)$. Determine the velocity potential function of the flow.

5. Attempt any one part of the following: 10x1=10

- (a) Illustrate:
- (i) Major and minor Losses
 - (ii) Siphon
 - (iii) Boundary lay on flat plate
 - (iv) Velocity distribution of turbulent flow
 - (v) Equivalent pipe
- (b) Derive the Momentum and Kinetic energy correction factor for a laminar flow of a fluid through a pipe

6. Attempt any one part of the following: 10x1=10

- (a) Explain:
- (i) Difference between Turbine and Pump
 - (ii) Governing of hydroturbine
 - (iii) Function of Draft tube
- (b) A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kwpower. It is working under a head of 7.62 m. The peripheral velocity = $0.26 \sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96 \sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, Determine:
- (i) The guide blade angle
 - (ii) The wheel vane angle at inlet
 - (iii) Diameter of the wheel ant inlet
 - (iv) Width of the wheel at inlet

7. Attempt any one part of the following: 10x1=10

- (a) Explain:
- (i) Derive the expression of minimum speed of starting of centrifugal pump.
 - (ii) Derivation of Work done by single acting reciprocating pump.
- (b) Explain and define ideal indicator diagram. Discuss the effect of acceleration in suction and delivery pipe on indicator diagram of reciprocating pump.