Printed Pages:02 **Sub Code:KME-302**

Paper Id: 233387 **Roll No.** | | | | | | | | | | |

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 Speedof 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 temperatureof the liquid is 200^0C and the values of the surface tension of water andmercury at 200^0C 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 130^0. Take density of water at 200^0C as equal to 998 kg/m^3.
(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 √2gH andthe radial velocity of flow at inlet is 0.96 √2gH . The wheel runs at 150 r.p.m. and thehydraulic losses in the turbine are 22% of the available energy. Assuming radialdischarge, 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.