

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023****Subject Code:3141906****Date:11-07-2023****Subject Name:Fluid Mechanics and Hydraulics Machines****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

MARKS

- Q.1** (a) Define the following fluid properties: **03**
1. Kinematic viscosity
 2. Vapour pressure
 3. The bulk modulus of compressibility
- (b) Define cohesion and adhesion characteristics of the fluid. **04**
When detergent is mixed with water, which characteristic of water is affected? How?
- (c) List out forces acting on the fluid in motion. Discuss assumptions made in Bernoulli's equation. Also, List out the limitations of Bernoulli's equation. **07**
- Q.2** (a) Define: **03**
1. Stream line
 2. Streak line
 3. Path line
- (b) Write a statement of Pascal's law and hydrostatic law. **04**
- (c) Explain Raynolds experiment with proper diagrams. Distinguish between Laminar and Turbulent flow. **07**
- OR**
- (c) A shaft of 100 mm diameter moves in a sleeve of length 350 mm at a speed of 0.4 m/s under the application of 250 N force in the direction of its motion. If the clearance between the shaft and sleeve is 0.08 mm, determine the dynamic viscosity of the lubricating oil filled in a clearance gap. **07**
If the applied force is increased to 750 N, what will be the speed of the sleeve?
- Q.3** (a) Explain the condition of stability for floating and submerged body. **03**
- (b) Define – **04**
1. Buoyant force
 2. Center of buoyancy
 3. Metacenter
 4. Metacentric height
- (c) A wooden block having a horizontal cross section 600 mm × 600 mm and height h . If floats vertically in water. Determine maximum height of the block so that it can remain in stable condition. Consider specific gravity of wood as 0.6. **07**
- OR**
- Q.3** (a) Define and explain circulation? What is the importance of concept of circulation? **03**
- (b) Sketch the velocity distribution and shear stress distribution across a section of the pipe for laminar flow. **04**
- (c) Check whether the flow of liquid given by $u = 5x$ and $v = -5y$ is (i) Continuous **07**
(ii) Rotational

- Q.4** (a) Write a short note on Kinetic energy correction factor. **03**
 (b) What is similitude? Define Geometric, Kinematic and Dynamic similarity. **04**
 (c) Discharge Q of a centrifugal pump can be assumed to be dependent on density of liquid ρ , viscosity of liquid μ , pressure p , impeller diameter D and speed N in RPM. **07**
 Using Buckingham π -theorem, show that:

$$Q = ND^3 \phi \left[\frac{gH}{N^2 D^2}, \frac{\nu}{ND} \right]$$

OR

- Q.4** (a) If the surface tension at air and water interface is 0.0735 N/m, what is the pressure difference between inside and outside of an air bobble of diameter 0.01 mm? **03**
 (b) Write down difference between impulse and reaction Water turbines. **04**
 (c) Explain components and constructional features of Francis Turbines with neat schematic diagrams. **07**

- Q.5** (a) Explain cavitation for hydraulic turbines. **03**
 (b) List out and explain heads in a centrifugal pump. **04**
 (c) A jet of water of diameter 7 cm strikes a curved plate at its center with velocity of 15 m/s. The curved plate is moving with a velocity of 7 m/s in the direction of the jet and it is deflected through an angle of 165° . Assuming the plate to be smooth. Determine: (i) Force exerted on plate in the direction of jet, (ii) Power of jet, and (iii) Efficiency of jet. **07**

OR

- Q.5** (a) Define following terms for centrifugal pump: **03**
 1. Manometric Efficiency
 2. Volumetric Efficiency
 3. Mechanical Efficiency
 (b) List out and explain losses in a centrifugal pump. **04**
 (c) Explain hydraulic press with schematic diagram, advantages, disadvantages and applications. **07**
