

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:3141906****Date:17-01-2024****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 (i) viscosity (ii) capillary rise or fall (iii) compressibility **03**
 (b) State and derive hydrostatic law. **04**
 (c) Derive Bernoulli's equation and write statement of theorem. **07**
- Q.2** (a) What are repeating variables? How are these selected by dimensional analysis? **03**
 (b) Define and explain the working of "Draft tube" **04**
 (c) An annular circular plate of 2 m external diameter and 1 m internal diameter is immersed vertically in water so that its lowest edge is 5 m below the free water surface. Determine the total force and position of center of pressure. **07**
- OR**
- (c) Derive the equation of discharge through a venturi meter. **07**
- Q.3** (a) Define (i) vorticity (ii) velocity potential (iii) stream function **03**
 (b) Check whether velocity components u , v and w satisfy continuity or not. **04**
 $u = x^3 + y^3 - 3xz^2$, $v = y^3 - 3x^2y$, $w = x^3 + z^3 - 3y^2z$
 (c) Water is to be supplied to the inhabitants of a college hostel through a supply main. **07**
 The following data are given:
 Distance of the reservoir from the hostel = 4000 m; Number of inhabitants = 3000;
 Consumption of water per day of each inhabitant = 180 litres; Loss of head due to friction = 18 m; co-efficient of friction for the pipe $f = 0.007$.
 If the half of the daily supply is pumped in 8 hrs, determine the size of the supply main.
- OR**
- Q.3** (a) Define (i) atmospheric pressure (ii) gauge pressure (iii) vacuum pressure **03**
 (b) Make comparison of laminar and turbulent flow. **04**
 (c) Assuming the viscous force F exerted by a fluid on sphere of diameter D depends on viscosity ' μ ', mass density ' ρ ' and velocity of sphere ' V '. Obtain expression for the viscous force **07**
 $F = D^2 V^2 \rho \phi(\mu/DV\rho)$
- Q.4** (a) What is an equivalent pipe? **03**
 (b) Explain construction and working of Rotameter **04**

- (c) A horizontal jet of water with a velocity of 30 m/s impinges on a moving curved blade having velocity of 12 m/s. The blade is moving in the direction of jet. The jet leaves the blade at an angle of 65° with the direction of motion of the blade. Blade outlet angle is 35° . Calculate (i) %age by which relative velocity is reduced at outlet (ii) Force per kg in the direction of motion if diameter of jet is 10 cm and (iii) work done per kg **07**

OR

- Q.4** (a) Give classification of hydraulic turbines **03**
(b) Calculate the discharge through a pipe of diameter 250 mm when the difference of pressure head between the two ends of a pipe 500 mm apart is 3.5m of water. Take value of friction factor =0.04. **04**
(c) Explain governing system of impulse hydraulic turbine. **07**

- Q.5** (a) Define priming. Why priming is necessary in centrifugal pump? **03**
(b) State and prove 'Pascal's Law'. **04**
(c) With neat sketch explain construction and working of hydraulic accumulator. **07**

OR

- Q.5** (a) Explain the advantages of Kaplan turbine over Francis turbine. **03**
(b) Prove that maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of flow. **04**
(c) With neat sketch explain construction and working of torque converter. **07**
