

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER– III(NEW) EXAMINATION – WINTER 2022****Subject Code:3130502****Date:20-02-2023****Subject Name:Fluid Flow Operations****Time:02:30 PM TO 05:00 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.

- Q.1** (a) (1) Define Slip of reciprocating pump. When the negative slip does occur? **03**  
 (2) Define Stagnation point.  
 (3) Give the example of pseudoplastic fluids.
- (b) Briefly describe boundary layers formation in straight pipe. **04**
- (c) Calculate the critical velocity of water flowing through 25 mm i.d. pipe. **07**  
 Density of water = 1000 kg/m<sup>3</sup>  
 Viscosity of water = 0.0008 (N.s)/m<sup>2</sup>

- Q.2** (a) Show that momentum correction factor  $\beta = 4/3$  for laminar flow of **03**  
 incompressible Newtonian fluid through a circular pipe.
- (b) Derive the Hagen-Poiseuille equation. **04**
- (c) Sugar syrup is flowing through a pipe of 55 mm i.d. at a rate of 66.67 cm<sup>3</sup>/s. **07**  
 The viscosity of the syrup is 0.15 (N.s)/m<sup>2</sup> and its density is 1040 kg/m<sup>3</sup>.  
 Calculate the frictional loss over a length of 10 meters.

**OR**

- (c) A 300 mm pipe carries water at a velocity of 24 m/s. At stations A and B **07**  
 measurements of pressure and elevation were 361 kN/m<sup>2</sup> and 288 kN/m<sup>2</sup> and  
 30.5 m and 33.5 m, respectively. For steady flow, find the loss of head  
 between stations A and B.

- Q.3** (a) Discuss in brief separation of boundary layers in diverging channel. **03**
- (b) Explain the concept of isothermal friction flow with diagram. **04**
- (c) A single acting reciprocating pump having a cylinder diameter of 150 mm and **07**  
 a stroke of 300 mm length discharges 200 lit/min of water at 40 r.p.m. Find  
 the theoretical discharge in lit/min and the percentage slip of the pump.

**OR**

- Q.3** (a) Show that kinetic energy correction factor  $\alpha = 2$  for laminar flow of **03**  
 incompressible Newtonian fluid through a circular pipe.
- (b) Discuss in brief pipe and fittings. **04**
- (c) A centrifugal pump with an efficiency of 65% is driven by an electric motor **07**  
 having an efficiency of 90%. The pump delivers water at a rate of 4 kg/s  
 against the total head of 25 m. Calculate the power required by the motor and  
 the power delivered by the motor to the pump.

- Q.4** (a) Write down equation to calculate power required by adiabatic compressor **03**  
 (PB) in SI units. Briefly describe effect of different variables on PB.
- (b) Define hydraulic radius and write down the formula for the equivalent **04**  
 diameter.

- (c) The pressure drop per unit length ' $p$ ' due to the friction in a pipe depends upon the diameter ' $d$ ' the mean velocity ' $v$ ' the density ' $\rho$ ' and the dynamic viscosity ' $\mu$ '. Find the relation between these variable. **07**

**OR**

- Q.4** (a) Discuss in brief about assembly used for prevention of leakages around moving parts of machine. **03**  
(b) Write a short note on mechanical seal. **04**  
(c) In a flow system there are two globe valves, each equivalent to 200 pipe diameters and fittings equivalent to 100 pipe diameters. What will be the total equivalent length of the piping system, if the diameter of pipe is 40 mm and pipe line is 200 m long? **07**

- Q.5** (a) What is skin friction and form friction? **03**  
(b) Explain asterisk condition and stagnation condition. Derive the expression for Stagnation temperature. **04**  
(c) Explain fully developed flow. Also discuss concept of transition length for laminar and turbulent flow. **07**

**OR**

- Q.5** (a) Distinguish between notch and weir. **03**  
(b) Briefly describe the concept of insertion meter. **04**  
(c) Discuss various types of flow observed in two phase flow. **07**

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