

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 3130502

Date: 03/07/2026

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) Define: Mass velocity, average velocity, stream lines and stream tubes. **03**
- (b) Discuss velocity Distribution for laminar flow of Newtonian fluids in a circular channel. **04**
- (c) Develop mathematical expression for hydrostatic equilibrium. **07**
- Q.2** (a) Write a short note on laminar and turbulent flow. **03**
- (b) Derive equation for kinetic energy correction factor of a unit mass of fluid flowing at the same velocity. **04**
- (c) Water flows through a 25 mm diameter pipeline at a rate of 0.8 l/s. If the temperature of water is 303 K (30°C), determine the type of flow. At 303 K (30°C) the density of water is 996 kg/m³ and the viscosity of water is 0.8 mPa.s. **07**
- OR
- Q.2** (c) A simple U-tube manometer is installed across an orifice meter. The manometric fluid is mercury (sp. gr. 13.6) and flowing fluid through piping is carbon tetrachloride (sp. gr. 1.6). The manometer reads 200 mm. What is the pressure difference over a manometer in N/m² ? **07**
- Q.3** (a) Discuss Reynolds number with reference to Reynolds experiment. **03**
- (b) Explain effect of roughness. **04**
- (c) Discuss friction loss in sudden expansion and sudden contraction in cross sectional area of pipe for incompressible flow. **07**
- OR
- Q.3** (a) What is Schedule number, why is it used? **03**
- (b) Describe pump work in Bernoulli's equation. **04**
- (c) Define mach number and explain in detail about isentropic flow of compressible fluid. **07**
- Q.4** (a) Give two applications in chemical industries where centrifugal pump cannot be used. **03**
- (b) Explain centrifugal decanter. **04**
- (c) Calculate the net positive suction head (NPSH) of a centrifugal pump using the following data : **07**
- (i) Vapour pressure of the liquid = 26.66 kN/m².
- (ii) Distance between the level of liquid in the reservoir and suction line = 1.2 m.
- (iii) Density of the liquid = 865 kg/m³.
- (iv) Friction in the suction line = 3.5 J/kg.
- (v) Reservoir is open to atmosphere.

OR

- Q.4** (a) Illustrate the detailed classification of pumps. **03**
- (b) Find the expression of power P developed by the pump, when the P depends upon head H , the discharge Q and specific weight w of the fluid. **04**
- (c) mild steel pipeline of 200 mm inside diameter is to be installed for transporting 16.7 kg/s of molasses. The pipeline is 1000 m long and the delivery end is to be 5 m higher than the intake. Calculate the power requirement for the pump if the efficiency of the pump is 60%. **07**
- Data : Density of molasses = 1600 kg/m^3 and μ of molasses = 0.5 Pa.s
- Q.5** (a) Discuss flow of compressible fluid through convergent – divergent nozzle. **03**
- (b) Time period of the pendulum depends upon length (l) of the pendulum and acceleration due to gravity (g). Derive the expression for the time period. **04**
- (c) A venturimeter is installed in a pipe line for the measurement of flow rate of water. The pressure drop across the throat and upstream of the meter is 10 centimeters of mercury. Calculate the volumetric flow rate of water in m^3/s . **07**
- Data :**
Diameter of throat = 15 mm
Diameter of pipe = 25 mm
Coefficient of meter = 0.98
Density of water = 1000 kg/m^3
Density of mercury = 13600 kg/m^3
- OR
- Q.5** (a) Write a short note on fluidization. **03**
- (b) Explain asterisk condition and stagnation condition. Derive the expression for Stagnation temperature. **04**
- (c) A 250 mm diameter pipe carries oil at a rate of 120 l/s and pressure at a point A (station 1) is $19.62 \text{ (kN/m}^2 \cdot \text{g)}$. If the point A is 3.5 m above the datum line, calculate the total energy at point A in m of oil. The specific gravity of oil is 0.8 and the density of water is 1000 kg/m^3 . **07**
