

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III (NEW) EXAMINATION – WINTER 2023

Subject Code:3130502

Date:12-01-2024

Subject Name:Fluid Flow Operations

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) Classify the fluids based on the externally applied temperature and pressure with suitable examples. **03**
- (b) Write a short note on laminar and turbulent flow. **04**
- (c) A centrifuge bowl 250-mm ID (internal diameter) is turning at 4000 rad/min. It contains a layer of chlorobenzene 50-mm thick. The density of the chlorobenzene is 1109 kg/m^3 and the pressure at the liquid surface is atmospheric, what gauge pressure is exerted on the wall of the centrifuge bowl? **07**
- Q.2**
- (a) Discuss the importance of average velocity and derive equation for the same. **03**
- (b) Derive equation for kinetic energy correction factor of a unit mass of fluid flowing at the same velocity. **04**
- (c) The flow has the following conditions in an air pipeline. **07**
- At point 1, temperature = 298 K, pressure = 1.8 bar, velocity of fluid through pipeline = 15 m/s, pipeline internal diameter = 50-mm and density of air = 2.1 kg/m^3 . At point 2, temperature = 298 K, pressure = 1.3 bar and pipeline internal diameter = 75-mm. Estimate the mass flow rate and velocity of air at point 2.
- OR**
- (c) A pipeline 300-m long has a slope of 1 in 100 and tapers from 1.2-m ID at higher end to 0.6-m ID at lower end. The quantity of water flowing through the pipe is 90 lit/s. If the pressure at higher end is 68.67 kPa, find the pressure at the lower end. Neglect the frictional losses. **07**
- Q.3**
- (a) Define friction factor and establish the relation between skin friction parameters. **03**
- (b) Water is flowing through a 25-mm pipe at the rate of 1 kg/s. Calculate the pressure drop over length of 100 meters. The density and viscosity of water are 1000 kg/m^3 and 0.0008 Pa s respectively. **04**

- (c) Discuss in detail: comparison of devices for transportation of fluids. 07

OR

- Q.3** (a) Water is flowing at a velocity of 2.5 m/s through 25-mm ID pipe. Find out friction factor. The density and viscosity of water are 1000 kg/m³ and 0.0008 Pa s respectively. 03
- (b) Discuss the effect of roughness for flow through pipe. 04
- (c) Discuss friction factor for flow through channels of noncircular cross section. 07

- Q.4** (a) Write applications of vacuum pumps with suitable examples. 03
- (b) Explain jet ejector with the help of a neat diagram. 04
- (c) Develop the equation of flow measurement for venturimeter. 07

OR

- Q.4** (a) List the check valves and draw labeled diagram of any one. 03
- (b) Define (i) priming (ii) cavitation (iii) NPSH (iv) NPSHR 04
- (c) Sulfuric acid of density 1300 kg/m³ is flowing through a pipe of 50- mm ID. An orificemeter of 10-mm diameter is fitted in the pipe. A mercury (sp. gr 13.6) manometer fitted to the system measures the differential pressure as 10-cm. Calculate the mass flow rate of the acid in kg/hr. Assume orifice coefficient as 0.61. 07

- Q.5** (a) Define Schedule number & BWG. 03
- (b) Distinguish between notch and weir. 04
- (c) Discuss with one example the Rayleigh method applied to dimensional analysis in fluid flow operation. 07

OR

- Q.5** (a) Distinguish between area meters and insertion meters. 03
- (b) Discuss in brief: pipe and tubing 04
- (c) A centrifugal fan is used to take flue gas at rest and at a pressure of 737 mmHg and a temperature of 93.3 °C and a discharge it at a pressure of 765 mmHg and a velocity of 45.7 m/s. Calculate the power needed to move 16,990 m³/hr of gas using standard condition of 760 mmHg and 0 °C. The efficiency of the fan is 65 percent and the molecular weight of the gas is 31.3. 07
