Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2130502 **Date: 05/06/2017**

Subject Name: Fluid Flow Operation

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.**

Q.1 **Answer the following questions.** **14**

1 Define: (i) unit operation, (2) unit process
2 Define potential flow.
3 Define laminar flow.
4 What is continuity equation?
5 Define Mach number.
6 Define sphericity.
7 Define schedule number.
8 Define cavitation.
9 For laminar flow in pipe, what is the value of kinetic energy correction factor?
10 Which flow measuring device can be used to measure flow of fluid through open channel?
11 Define stream line and stream tube.
12 What are the units of viscosity and kinematic viscosity?
13 Define stagnation temperature.
14 Define power number.

Q.2

(a) Briefly describe the flow of fluid in boundary layers. **03**

(b) With neat sketch describe the working of centrifugal decanter. **04**

(c) Describe the rheological behavior of Newtonian and non-Newtonian fluids. **07**

OR

(c) The power requirement **P** for an cylinder is dependent on the propeller diameter **D**, its rotational speed **N**, liquid density ρ, Viscosity μ & gravitational acceleration **g**. Find the correct representation for the power consumption in terms of dimensionless groups using Buckingham-Π method. **07**

Q.3 **(a)** Calculate the viscosity of air at temperature 300 K. **03**
Data given: At 273 K, viscosity of air is 0.0165 centipoise.

(b) Define roughness parameter. Briefly describe different types of roughness with neat sketch. **04**

(c) Derive Bernoulli equation without friction with all assumptions. **07**

OR

Q.3 **(a)** Define: (1) skin friction, (2) friction factor **03**

(b) Derive Hagen-Poiseuille equation. **04**

(c) Water at a rate 200 tons/h has to be pumped from a river to the factory overhead tank placed at a height of 25 m from the river bed. Total length of pipe line being 1.5 km. Cast iron pipe having inner diameter of 30 cm will be used for the purpose. The average temperature of water in the river may be taken as 30 °C, for which condition viscosity is 0.764 cp. Calculate Reynolds's number and friction factor. **07**

Friction factor is given by: $f = 0.0014 + \frac{0.125}{Re^{0.32}}$

Q.4 **(a)** "Velocity of compressible fluids, obtainable in isothermal flow is less than that in adiabatic flow". True or False? Why? Explain. **03**

(b) Air enters a convergent-divergent nozzle at a temperature 400 K and pressure of 40 atm. Assuming Mach number in the throat is 0.6, what is the value of pressure at throat, if flow is isentropic? **04**
Data given: For air $\gamma = 1.4$, Molecular weight = 29 gm/mol

(c) Derive the equation to calculate critical pressure ratio (r_c) for isentropic flow of compressible fluid. **07**

OR

Q.4 **(a)** Describe form friction losses in Bernoulli equation with suitable example. **03**

(b) Describe particulate fluidization. **04**

(c) Derive Ergun equation. **07**

Q.5 **(a)** Differentiate between pipe and tubing. **03**

(b) With neat sketch briefly describe the gate valve and globe valve. **04**

(c) Differentiate between variable head flow meters and variable area flow meters. Describe any one variable area meter. **07**

OR

Q.5 **(a)** Write down equation to calculate power required by adiabatic compressor (P_B) in SI units. Briefly describe effect of different variables on P_B **03**

(b) Describe the classification of pumps. **04**

(c) Describe characteristic curves of centrifugal pump with neat sketches. **07**

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