Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III EXAMINATION – WINTER 2015

Subject Code:130502 **Date:29/12/2015**

Subject Name: Fluid Flow Operation

Time: 2:30pm to 5:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Answer the following questions. **08**

i. State the physical significance of Reynolds number.
ii. Define Mach number.
iii. What is difference between compressible and incompressible fluid?
iv. Define potential flow.
v. Define priming.
vi. What is function of check valve.
vii. Define drag.
viii. What is schedule number?

(b) Answer the following questions. **06**

i. Define NPSH. For pump, NPSHA values must be more than NPSHR. True or False? Why?
ii. To achieve same Mach number, velocity of compressible fluid obtained in isothermal flow is less than that in adiabatic flow. True or False? Why?
iii. Drag coefficient in hindered settling is greater than in free settling. True or False? Why?

Q.2 **(a)** Write a short note on centrifugal decanter. **07**

(b) Describe rheological characteristics of fluid. **07**

OR

(b) Describe boundary layer formation in straight tubes. **07**

Q.3 **(a)** Derive Hagen-Poiseuille equation. **07**

(b) A nozzle is fitted to a large vessel containing air at a pressure 4905 kPa and temperature 300 K. Air flows out steadily through the nozzle at the outlet of which air pressure is 3433.5 kPa. Calculate velocity of air at the nozzle outlet (u) in m/s. **07**

Data Given: $\gamma = 1.4$, $M_{air} = 28.84 \dfrac{kg}{kgmol}$ and $u^2 = \dfrac{2\gamma}{(\gamma-1)}\dfrac{P_0}{\rho_0}\left[1-\left(\dfrac{P}{P_0}\right)^{\left(1-\frac{1}{\gamma}\right)}\right]$

OR

Q.3 **(a)** Derive Bernoulli equation without friction. **07**

	(b)	Explain any one method of dimensional analysis.	**07**
Q.4	**(a)**	Write a short note on pipe and tubing.	**07**
	(b)	Derive Ergun equation.	**07**

OR

Q.4	**(a)**	Define cavitation. How to prevent cavitation? A fuel oil pump delivers 400 m^3 of fuel oil per minute by consuming 2.5 MW of electric power. The fuel oil's relative density is 0.95. Determine the efficiency of the pump if the total head developed by it is 32 met.	**07**
	(b)	Write a short note on types of fluidization.	**07**
Q.5	**(a)**	Differentiate between Rota meter and orifice meter. Briefly describe pitot tube.	**07**
	(b)	Explain the characteristic curves for centrifugal pump.	**07**

OR

Q.5	**(a)**	A single stage reciprocating compressor is used to compress 306 m^3/h of methane from 0.95 atm to 5 atm abs, isothermally. The inlet temperature is 26.7 °C. Calculate the power required by compressor, if efficiency of compressor is 80%.	**07**
	(b)	The rate of flow of water in a 150 mm diameter pipe is measured with a venturi meter with a 50 mm diameter throat. When the pressure drop over the converging section is 121 mm of water, the flow rate is 2.91 kg/s. What is the coefficient for the converging cone of the meter at this flow rate?	**07**

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