Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) • EXAMINATION – WINTER 2016

Subject Code:2130502 **Date:06/01/2017**

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.**

			Marks
Q.1		**Short Questions**	**14**
	1	Define specific gravity of a fluid and also mention its importance.	
	2	Write two important characteristics of a potential flow.	
	3	Describe industrial application of centrifugal decanter.	
	4	State the principle of microscopic momentum balance.	
	5	Name the instrument used for measurement of stack gas velocity and difference in the dynamic pressure of a flowing fluid.	
	6	Define Fanning friction factor and write its relation to Reynold's number for laminar flow of incompressible Newtonian fluid through circular pipe.	
	7	1 Poise = _____ cP = _____ Kg/m sec.	
	8	Define vena – contracta for flow of fluid through orifice meter.	
	9	State the theoretical value of discharge co-efficient for orifice meter and venturi meter.	
	10	Does the external diameter of pipe get varies with schedule number?	
	11	Define cavitation in centrifugal pump.	
	12	Write physical significance of Mach number and also classify the flow of compressible fluid based on Mach number.	
	13	What is meant by minimum fluidization velocity?	
	14	List out various types of reciprocating pump based upon the reciprocating member or pressure component.	
Q.2	**(a)**	Classify the time independent fluids with neat sketch and suitable examples.	**03**
	(b)	Show that $P_X = P_Y = P_Z$ at a point within the static fluid.	**04**
	(c)	Derive an expression used for measurement of pressure distribution in the deep gas container.	**07**
		OR	
	(c)	List out the assumptions made to derive the Bernoulli's equation for potential flow. Also discuss kinetic energy correction factor, correction for fluid friction	**07**

and pump work in the Bernoulli's equation.

Q.3 **(a)** Show that momentum correction factor $\beta = 4/3$ for laminar flow of incompressible Newtonian fluid through a circular pipe. **03**

(b) Discuss the relation between skin friction parameters and derive Hagen – Poiseuille equation used to measure pressure drop per unit length of pipe. **04**

(c) Show that average velocity is one – half of the maximum velocity for laminar flow of incompressible Newtonian fluid through a circular pipe. **07**

OR

Q.3 **(a)** Show that kinetic energy correction factor $\alpha = 2$ for laminar flow of incompressible Newtonian fluid through a circular pipe. **03**

(b) Show that shear stress distribution is linear function of radius of pipeline for fully developed flow of incompressible Newtonian fluid through horizontal circular pipe. **04**

(c) Derive an expression for head loss due to sudden expansion in flow area. **07**

Q.4 **(a)** Discuss in brief about assembly used for prevention of leakages around moving parts of machine. **03**

(b) A bed of ion-exchange beads 8-ft deep is to be back washed to remove dirt with water having a viscosity 0.01 poise. The particle have a density 1.24 g/cm^3 and an average size of 1.1 mm. What is the minimum fluidization velocity of water at 20 ^{o}C? The beads are assumed to be spherical and ε_m is taken as 0.4. **04**

(c) Starting with Bernoulli's and continuity equation, develop the equation for discharge measured by orifice meter. **07**

OR

Q.4 **(a)** The liquid of a density 865 kg/m^3 and vapor pressure 26.66 kN/m^2 is pumped. The distance between the level of liquid in the reservoir and suction line is 1.2 meter. Loss due to friction in suction line is 3.5 J/kg and reservoir is open to atmosphere. Calculate the net positive suction head of the pump. **03**

(b) Discuss the construction and working of variable area meter with neat sketch. **04**

(c) Discuss the conditions for fluidization with neat sketch. Also mention application of fluidization in chemical industries. **07**

Q.5 **(a)** Discuss flow of compressible fluid through convergent – divergent nozzle. **03**

(b) Explain differences between fan, blower and compressor. **04**

(c) The power requirement for an agitator is dependent on the propeller diameter, its rotational speed, liquid density, liquid viscosity and the gravitational acceleration. Find the correct representation for the power consumption in **07**

terms of dimensionless groups by using Rayleigh method of dimensional analysis. Also name each dimensionless groups and write its physical significance.

OR

Q.5	**(a)**	Define drag coefficient. Show relationship between drag co-efficient and Reynold's No.	**03**
	(b)	List various types of valves and mention their specific application in chemical industry.	**04**
	(c)	The pressure drop for the flow of fluid through long, straight and circular pipe depends upon the length and diameter of pipe as well as velocity, density and viscosity of a fluid. Express the pressure drop as a function of dimensionless groups by using Buckingham's π theorem for dimensional analysis.	**07**

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