Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

Subject Code: 3130502 Date: 26/11/2019

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.**

			Marks
Q.1	**(a)**	Define: (i) Potential flow (ii) Streamline flow (iii) Fully developed flow	**03**
	(b)	State and discuss Newton's law of viscosity and concept of viscosity.	**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**
Q.2	**(a)**	Define hydraulic radius and write down the formula for the equivalent diameter.	**03**
	(b)	Discuss velocity Distribution for laminar flow of Newtonian fluids in a circular channel	**04**
	(c)	Discuss the concept of hydrostatic equilibrium and derive mathematical condition of hydrostatic equilibrium.	**07**
		OR	
	(c)	Derive equation for Gravity Decanter relating Total depth, depth of each fluid and densities of fluid and time required for the separation	**07**
Q.3	**(a)**	Define: Mass velocity, average velocity, stream lines and stream tubes.	**03**
	(b)	Explain concept of kinematic viscosity along with its significance.	**04**
	(c)	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.	**07**
		OR	
Q.3	**(a)**	What is Schedule number, why is it used?	**03**
	(b)	Explain cavitation and priming with suitable example	**04**
	(c)	Derive the Bernoulli's equation. Explain the corrections applied and significance of the terms involved in it.	**07**
Q.4	**(a)**	Write significance of Mach number and acoustic velocity.	**03**
	(b)	Discuss flow of compressible fluid through convergent-divergent nozzles.	**04**
	(c)	Develop the flow equation for any one variable head meter; also discuss its applications and limitations.	**07**

OR

Q.4	**(a)**	Enlist different types of valves used in pipe fittings.	**03**
	(b)	A pitot tube is used to measure velocity of water at the center of a pipe, the stagnation pressure head is 6 m and static pressure head is 5 m of water. Determine the flow velocity assume C_d= 0.98	**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. Develop an expression for the pressure drop as a function of dimensionless groups by using Buckingham's π theorem for dimensional analysis.	**07**
Q.5	**(a)**	Discus in brief Drag force and Drag coefficient.	**03**
	(b)	Give two applications in chemical industries where centrifugal pump cannot be used.	**04**
	(c)	Water is to be pumped from ground level tank, which is open to atmosphere to a cooling tower. The difference between the level of water in the tank and discharge point is 15 m. The velocity of water through 40 mm internal diameter discharge pipe is 3 m/s. In the pipe line there is a valve which is equivalent to 200 pipe diameters and fitting equivalent to 150 pipe diameters. The length of the entire is 30 meters. Calculate the power requirement of the pump if efficiency of pump is 60%. Data : density of water = 1000 kg/m^3 Viscosity of water = 0.0008 PaS. Friction factor 'f' = 0.004.	**07**

OR

Q.5	**(a)**	What is boundary layer separation and wake formation?	**03**
	(b)	Differentiate between pipes and tubes.	**04**
	(c)	Derive equation of continuity considering velocity in three dimensions.	**07**