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**

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2020

Subject Code:3130502 Date:09/03/2021

Subject Name:Fluid Flow Operations

Time:10:30 AM TO 12:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT 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**
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**
Q.4	**(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.5	**(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**
Q.6	**(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.7	**(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**
Q.8	**(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**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2021

Subject Code:3130502 Date:17-02-2022

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)**	Define: 1) Ideal fluid 2) Compressible fluid and 3) Incompressible fluid.	**03**
	(b)	Discuss the concept of hydrostatic equilibrium.	**04**
	(c)	Explain in detail Newtonian and Non-Newtonian fluids with suitable examples.	**07**
Q.2	**(a)**	Discuss Reynolds number with reference to Reynolds experiment.	**03**
	(b)	With neat sketch, explain the principle and working of gravity decanter.	**04**
	(c)	Derive Bernoulli's equation without friction and write the assumptions.	**07**
		OR	
	(c)	Explain boundary layer separation and wake formation.	**07**
Q.3	**(a)**	Define friction and write short note on friction factor chart.	**03**
	(b)	A crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres per sec. Find the head lost due to friction for a length of 50 m of the pipe.	**04**
	(c)	Prove that kinetic energy correction factor for laminar flow of newtonian fluids through circular pipe is 2.	**07**
		OR	
Q.3	**(a)**	Discuss the concept of fully developed flow.	**03**
	(b)	Explain effect of roughness.	**04**
	(c)	Discuss friction loss in sudden enlargement and sudden contraction in cross sectional area of pipe.	**07**
Q.4	**(a)**	What do you mean by subsonic, sonic and supersonic flows?	**03**
	(b)	What is kinematic viscosity? Discuss the effect of temperature on viscosity.	**04**
	(c)	Explain in detail drag and drag coefficient.	**07**
		OR	
Q.4	**(a)**	Distinguish between compressor and blower.	**03**
	(b)	Explain in detail about isentropic flow of compressible fluid.	**04**
	(c)	List the different dimensional analysis methods applied to fluid flow and explain any one method in detail.	**07**
Q.5	**(a)**	What are the advantages of Centrifugal pump over Reciprocating pump?	**03**
	(b)	Distinguish between pipes and tubes.	**04**
	(c)	With neat sketch, explain the principle and working of rotameter.	**07**
		OR	
Q.5	**(a)**	Define cavitation. What are some common best practices to prevent cavitation?	**03**
	(b)	Discuss the working of Gate valve and Globe valve.	**04**
	(c)	With neat sketch explain principle, construction and working of a centrifugal pump.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2021

Subject Code:3130502 Date:06/09/2021

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)**	Define: (i) Potential flow (ii) Streamline flow (iii) Momentum diffusivity	**03**
	(b)	Describe the behavior of Newtonian and Non Newtonian fluid with the help of figure and example	**04**
	(c)	Derive the Bernoulli's equation. Write the necessary assumptions. Explain the corrections applied to it.	**07**
Q.2	**(a)**	Define (i) Mass Velocity (ii) Average Velocity	**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)	The temperature of the earth's atmosphere drops about 5° C for every 1000 m of elevation above the earth's surface. If the air temperature at ground level is 15° C and the absolute pressure is 760 mm hg, at what elevation is the pressure 380 mm hg? Assume that air behaves as an ideal	**07**
Q.3	**(a)**	If a liquid enters a pipe of diameter d with a velocity v, what will it's velocity at the ex diameter reduces to 0.5 times the initial diameter?	**03**
	(b)	Discuss flow of compressible fluid through convergent – divergent nozzle.	**04**
	(c)	Derive an expression for head loss due to sudden expansion in flow area.	**07**
		OR	
Q.3	**(a)**	Sulfuric acid is pumped at 30 kg/min through a 60 m length of Smooth 25 mm pipe. Calculate the drop in pressure. $\rho = 1840$ kg/m^3, Viscosity=25 cp	**03**
	(b)	Derive Continuity equation for compressible fluids.	**04**
	(c)	An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 lit/sec. find the head loss due to friction and power requirement to maintain the flow for a length of 1000 meter. Momentum diffusivity of oil is 0.29 stock.	**07**
Q.4	**(a)**	Show that kinetic energy correction factor $\alpha = 2$ for laminar flow of incompressible Newtonian fluid through a circular pipe.	**03**
	(b)	Define Mach number and explain its significance.	**04**
	(c)	Define NPSH. And also derive the equation of NPSH.	**07**
		OR	
Q.4	**(a)**	Illustrate the detailed classification of pumps.	**03**
	(b)	Time period of the pendulum depends upon length (l) of the pendulum and acceleration due to gravity (g). Derive the expression for the time period.	**04**
	(c)	Explain construction and working of venturimeter With neat sketch, and also drive the flow equation of the same.	**07**

Q.5	**(a)**	Differentiate pipes and tubes.	**03**
	(b)	Explain the concept of drag force with example.	**04**
	(c)	Sulphuric acid is to be pumped at a rate of 3 kg/s through a 50 mm i.d. pipe over a straight run of 800 m and is then raised vertically 15 m. If the pump is electrically driven and has an efficiency of 50%, find the power required by the pump. Density=1650kg/m3.viscosity of the acid=0.0086 Pa.s.	**07**

OR

Q.5	**(a)**	List various types of valves and mention their specific application in chemical industry.	**03**
	(b)	Find the expression of power P developed by the pump, when the P depends upon head H, the discharge Q and specific weight w of the fluid.	**04**
	(c)	Two geometrically similar pumps are running at the same speed of 1000 r.p.m ,one pump has an impeller diameter of 0.30m and lift water at a rate of 20 lit/sec against head of 15m, determine head and impeller diameter of the other pump to deliver half the discharge.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022

Subject Code:3130502 Date:11-07-2022

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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define mass velocity, ideal fluid, and real fluid.	**03**
	(b)	Explain the Boundary layer, its separation, and wake formation.	**04**
	(c)	Develop the Bernoulli equation for incompressible fluid.	**07**
Q.2	**(a)**	Classify fluid.	**03**
	(b)	Define laminar and turbulent flow.	**04**
	(c)	Develop equation of pressure difference for inclined tube manometer.	**07**
		OR	
	(c)	Develop mathematical expression for hydrostatic equilibrium.	**07**
Q.3	**(a)**	Define potential flow, streamline and stream tubes.	**03**
	(b)	Explain continuous gravity decanter.	**04**
	(c)	Discuss about pressure drop in fluidization.	**07**
		OR	
Q.3	**(a)**	Write the significance of Mach number and acoustic velocity.	**03**
	(b)	Explain centrifugal decanter.	**04**
	(c)	Discuss flow of compressible fluid through convergent-divergent nozzles.	**07**
Q.4	**(a)**	Give barometric equation with nomenclature.	**03**
	(b)	Describe pump work in Bernoulli's equation	**04**
	(c)	Explain construction and working of the Gate valve.	**07**
		OR	
Q.4	**(a)**	Define viscosity and write down its unit.	**03**
	(b)	Describe correction for friction in Bernoulli's equation	**04**
	(c)	Explain the construction and working of the Globe valve.	**07**
Q.5	**(a)**	Define Newtonian and Non-Newtonian fluid.	**03**
	(b)	Water is flowing through a 25 mm internal diameter pipe at the rate of 1 kg/s. Calculate the pressure drop over a length of 100 meters. Data : Friction factor 'f ' = 0.0001 Data: Friction factor 'f ' = 0.0001 Density of water = 1000 kg/m^3 Viscosity of water = 8.0×10^{-4} Pa.s	**04**
	(c)	Crude oil has a specific gravity of 0.91 and a viscosity of 0.124 Pa s is pumped at a rate of 7 l/s through a pipeline 75 mm diameter having a length of 62 m and whose outlet is 3 m higher than its inlet. Determine the power required for the pump if its efficiency is 60%.	**07**

OR

Q.5	**(a)**	Define Compressible and Incompressible fluid.	**03**
	(b)	Acetic acid is to be pumped at a rate of 0.02 m^3/s through a 75 mm ID pipeline. Calculate the pressure drop in the pipeline over a length of 70 m. Data: Density of acetic acid = 1060 kg/m^3 Viscosity of acetic acid = 0.0025 $(N.s)/m^2$	**04**
	(c)	A venturi meter is to be fitted in a pipe of 250 mm diameter where the pressure head is 7.6 m of flowing fluid and the flow rate is 8.1 m3/min. Determine the diameter of the throat. Take the coefficient of venturi meter as 0.96.	**07**

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