Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III EXAMINATION – WINTER 2025

Subject Code:3130502 Date:31-12-2025

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 dynamic and kinematic viscosity.	**03**
	(b)	Write note on Laminar and turbulent flow.	**04**
	(c)	Discuss with neat sketch and suitable examples: the classification of time independent fluids.	**07**
Q.2	**(a)**	Explain the working of Target meter.	**03**
	(b)	Describe rotameter with neat sketch.	**04**
	(c)	Sulphuric acid of density 1300 kg/m^3 is flowing through a pipe of 50 mm ID. An orifice meter of 10 mm diameter is fitted in the pipe. A mercury (Specific Gravity13.6) manometer fitted to the system measures the differential pressure as 10 cm. Calculate the mass flow rate of the acid in kg/hr. Assume orifice coefficient as 0.61.	**07**
		OR	
	(c)	A venturimeter is to be fitted in a pipe of 250 mm diameter where pressure head is 7.6 m of flowing fluid and the maximum flow is 8.1 m^3 per minute. Determine the least diameter of the throat to ensure that the pressure head does not become negative. Take coefficient of venturimeter as 0.96.	**07**
Q.3	**(a)**	Define Cavitation, Priming and NPSH	**03**
	(b)	Give the difference between pipes and tubes.	**04**
	(c)	Develop the equation for the flow rate measurement staring from Bernoulli's Theorem and continuity equation for the venturimeter.	**07**
		OR	
Q.3	**(a)**	Give significance of the Reynold's number and prove that it is dimensionless.	**03**
	(b)	Give the classification of the different types of valves used in the pipe fitting.	**04**
	(c)	The power required by agitator in a tank is a function the diameter of the agitator, number of rotations of the impeller per unit time, viscosity and density of the liquid. Obtain the relationship using dimensional analysis using Buckingham Pi method between power and four variables.	**07**

Q.4	**(a)**	Define drag and drag coefficient.	**03**
	(b)	Explain difference between fans, Blowers and compressor	**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.4	**(a)**	Derive the expression for the effect of cross sectional area on velocity for the isentropic flow of compressible fluid through nozzle.	**03**
	(b)	Derive the equation to calculate critical pressure ratio (rc) for isentropic flow of compressible fluid.	**04**
	(c)	Define mach number and explain in detail about isentropic flow of compressible fluid.	**07**

Q.5	**(a)**	What is boundary layer separation and wake formation?	**03**
	(b)	Discuss velocity Distribution for laminar flow of Newtonian fluids in a circular channel.	**04**
	(c)	Discuss friction loss in sudden expansion and sudden contraction in cross sectional area of pipe for incompressible flow.	**07**

OR

Q.5	**(a)**	Describe form friction losses in Bernoulli equation with suitable example.	**03**
	(b)	Write a short note on prevention of leakage around moving parts.	**04**
	(c)	With neat sketch, explain principle construction and working of a centrifugal pump.	**07**

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Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2024

Subject Code: 3130502 Date: 21-11-2024

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)**	(1) Define Slip of reciprocating pump. When the negative slip does occur? (2) Define Stagnation point. (3) Give the example of pseudoplastic fluids.	**03**
	(b)	Briefly describe boundary layers formation in straight pipe.	**04**
	(c)	Calculate the critical velocity of water flowing through 25 mm i.d. pipe. Density of water = 1000 kg/m^3 Viscosity of water = 0.0008 (N.s)/m^2	**07**
Q.2	**(a)**	Show that momentum correction factor $\beta = 4/3$ for laminar flow of incompressible Newtonian fluid through a circular pipe.	**03**
	(b)	Derive the Hagen-Poiseuille equation.	**04**
	(c)	Sugar syrup is flowing through a pipe of 55 mm i.d. at a rate of 66.67 cm^3/s. The viscosity of the syrup is 0.15 (N.s)/m^2 and its density is 1040 kg/m^3. Calculate the frictional loss over a length of 10 meters.	**07**
		OR	
	(c)	A 300 mm pipe carries water at a velocity of 24 m/s. At stations A and B measurements of pressure and elevation were 361 kN/m^2 and 288 kN/m^2 and 30.5 m and 33.5 m, respectively. For steady flow, find the loss of head between stations A and B.	**07**
Q.3	**(a)**	Discuss in brief separation of boundary layers in diverging channel.	**03**
	(b)	Explain the concept of isothermal friction flow with diagram.	**04**
	(c)	A single acting reciprocating pump having a cylinder diameter of 150 mm and a stroke of 300 mm length discharges 200 lit/min of water at 40 r.p.m. Find the theoretical discharge in lit/min and the percentage slip of the pump.	**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)	Discuss in brief pipe and fittings.	**04**
	(c)	A centrifugal pump with an efficiency of 65% is driven by an electric motor having an efficiency of 90%. The pump delivers water at a rate of 4 kg/s against the total head of 25 m. Calculate the power required by the motor and the power delivered by the motor to the pump.	**07**
Q.4	**(a)**	Write down equation to calculate power required by adiabatic compressor (PB) in SI units. Briefly describe effect of different variables on PB.	**03**
	(b)	Define hydraulic radius and write down the formula for the equivalent diameter.	**04**
	(c)	The pressure drop per unit length ‘p’ due to the friction in a pipe depends upon the diameter ‘d’ the mean velocity ‘v’ the density ‘ρ’ and the dynamic viscosity ‘μ’. Find the relation between these variable.	**07**

OR

Q.4	**(a)**	Discuss in brief about assembly used for prevention of leakages around moving parts of machine.	**03**
	(b)	Write a short note on mechanical seal.	**04**
	(c)	In a flow system there are two globe valves, each equivalent to 200 pipe diameters and fittings equivalent to 100 pipe diameters. What will be the total equivalent length of the piping system, if the diameter of pipe is 40 mm and pipe line is 200 m long?	**07**
Q.5	**(a)**	What is skin friction and form friction?	**03**
	(b)	Explain asterisk condition and stagnation condition. Derive the expression for Stagnation temperature.	**04**
	(c)	Explain fully developed flow. Also discuss concept of transition length for laminar and turbulent flow.	**07**

OR

Q.5	**(a)**	Distinguish between notch and weir.	**03**
	(b)	Briefly describe the concept of insertion meter.	**04**
	(c)	Discuss various types of flow observed in two phase flow.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2023

Subject Code:3130502 Date:12-01-2024

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)**	Classify the fluids based on the externally applied temperature and pressure with suitable examples.	**03**
	(b)	Write a short note on laminar and turbulent flow.	**04**
	(c)	A centrifuge bowl 250-mm ID (internal diameter) is turning at 4000 rad/min. It contains a layer of chlorobenzene 50-mm thick. The density of the chlorobenzene is 1109 kg/m^3 and the pressure at the liquid surface is atmospheric, what gauge pressure is exerted on the wall of the centrifuge bowl?	**07**
Q.2	**(a)**	Discuss the importance of average velocity and derive equation for the same.	**03**
	(b)	Derive equation for kinetic energy correction factor of a unit mass of fluid flowing at the same velocity.	**04**
	(c)	The flow has the following conditions in an air pipeline. At point 1, temperature = 298 K, pressure = 1.8 bar, velocity of fluid through pipeline = 15 m/s, pipeline internal diameter = 50-mm and density of air = 2.1 kg/m^3. At point 2, temperature = 298 K, pressure = 1.3 bar and pipeline internal diameter = 75-mm. Estimate the mass flow rate and velocity of air at point 2.	**07**
		OR	
	(c)	A pipeline 300-m long has a slope of 1 in 100 and tapers from 1.2-m ID at higher end to 0.6-m ID at lower end. The quantity of water flowing through the pipe is 90 lit/s. If the pressure at higher end is 68.67 kPa, find the pressure at the lower end. Neglect the frictional losses.	**07**
Q.3	**(a)**	Define friction factor and establish the relation between skin friction parameters.	**03**
	(b)	Water is flowing through a 25-mm pipe at the rate of 1 kg/s. Calculate the pressure drop over length of 100 meters. The density and viscosity of water are 1000 kg/m^3 and 0.0008 Pa s respectively.	**04**

	(c)	Discuss in detail: comparison of devices for transportation of fluids.	**07**

OR

Q.3	**(a)**	Water is flowing at a velocity of 2.5 m/s through 25-mm ID pipe. Find out friction factor. The density and viscosity of water are 1000 kg/m^3 and 0.0008 Pa s respectively.	**03**
	(b)	Discuss the effect of roughness for flow through pipe.	**04**
	(c)	Discuss friction factor for flow through channels of noncircular cross section.	**07**
Q.4	**(a)**	Write applications of vacuum pumps with suitable examples.	**03**
	(b)	Explain jet ejector with the help of a neat diagram.	**04**
	(c)	Develop the equation of flow measurement for venturimeter.	**07**

OR

Q.4	**(a)**	List the check valves and draw labeled diagram of any one.	**03**
	(b)	Define (i) priming (ii) cavitation (iii) NPSH (iv) NPSHR	**04**
	(c)	Sulfuric acid of density 1300 kg/m^3 is flowing through a pipe of 50- mm ID. An orificemeter of 10-mm diameter is fitted in the pipe. A mercury (sp. gr 13.6) manometer fitted to the system measures the differential pressure as 10-cm. Calculate the mass flow rate of the acid in kg/hr. Assume orifice coefficient as 0.61.	**07**
Q.5	**(a)**	Define Schedule number & BWG.	**03**
	(b)	Distinguish between notch and weir.	**04**
	(c)	Discuss with one example the Rayleigh method applied to dimensional analysis in fluid flow operation.	**07**

OR

Q.5	**(a)**	Distinguish between area meters and insertion meters.	**03**
	(b)	Discuss in brief: pipe and tubing	**04**
	(c)	A centrifugal fan is used to take flue gas at rest and at a pressure of 737 mmHg and a temperature of 93.3 ºC and a discharge it at a pressure of 765 mmHg and a velocity of 45.7 m/s. Calculate the power needed to move 16,990 m^3/hr of gas using standard condition of 760 mmHg and 0 ºC. The efficiency of the fan is 65 percent and the molecular weight of the gas is 31.3.	**07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3130502 Date:20-02-2023

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.**

Q.1	**(a)**	(1) Define Slip of reciprocating pump. When the negative slip does occur? (2) Define Stagnation point. (3) Give the example of pseudoplastic fluids.	**03**
	(b)	Briefly describe boundary layers formation in straight pipe.	**04**
	(c)	Calculate the critical velocity of water flowing through 25 mm i.d. pipe. Density of water = 1000 kg/m^3 Viscosity of water = 0.0008 (N.s)/m^2	**07**
Q.2	**(a)**	Show that momentum correction factor $\beta = 4/3$ for laminar flow of incompressible Newtonian fluid through a circular pipe.	**03**
	(b)	Derive the Hagen-Poiseuille equation.	**04**
	(c)	Sugar syrup is flowing through a pipe of 55 mm i.d. at a rate of 66.67 cm^3/s. The viscosity of the syrup is 0.15 (N.s)/m^2 and its density is 1040 kg/m^3. Calculate the frictional loss over a length of 10 meters.	**07**
		OR	
	(c)	A 300 mm pipe carries water at a velocity of 24 m/s. At stations A and B measurements of pressure and elevation were 361 kN/m^2 and 288 kN/m^2 and 30.5 m and 33.5 m, respectively. For steady flow, find the loss of head between stations A and B.	**07**
Q.3	**(a)**	Discuss in brief separation of boundary layers in diverging channel.	**03**
	(b)	Explain the concept of isothermal friction flow with diagram.	**04**
	(c)	A single acting reciprocating pump having a cylinder diameter of 150 mm and a stroke of 300 mm length discharges 200 lit/min of water at 40 r.p.m. Find the theoretical discharge in lit/min and the percentage slip of the pump.	**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)	Discuss in brief pipe and fittings.	**04**
	(c)	A centrifugal pump with an efficiency of 65% is driven by an electric motor having an efficiency of 90%. The pump delivers water at a rate of 4 kg/s against the total head of 25 m. Calculate the power required by the motor and the power delivered by the motor to the pump.	**07**
Q.4	**(a)**	Write down equation to calculate power required by adiabatic compressor (PB) in SI units. Briefly describe effect of different variables on PB.	**03**
	(b)	Define hydraulic radius and write down the formula for the equivalent diameter.	**04**

	(c)	The pressure drop per unit length 'p' due to the friction in a pipe depends upon the diameter 'd' the mean velocity 'v' the density 'ρ' and the dynamic viscosity 'μ'. Find the relation between these variable.	**07**

OR

Q.4	**(a)**	Discuss in brief about assembly used for prevention of leakages around moving parts of machine.	**03**
	(b)	Write a short note on mechanical seal.	**04**
	(c)	In a flow system there are two globe valves, each equivalent to 200 pipe diameters and fittings equivalent to 100 pipe diameters. What will be the total equivalent length of the piping system, if the diameter of pipe is 40 mm and pipe line is 200 m long?	**07**

Q.5	**(a)**	What is skin friction and form friction?	**03**
	(b)	Explain asterisk condition and stagnation condition. Derive the expression for Stagnation temperature.	**04**
	(c)	Explain fully developed flow. Also discuss concept of transition length for laminar and turbulent flow.	**07**

OR

Q.5	**(a)**	Distinguish between notch and weir.	**03**
	(b)	Briefly describe the concept of insertion meter.	**04**
	(c)	Discuss various types of flow observed in two phase flow.	**07**

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