GANPAT UNIVERSITY

FACULTY OF DIPLOMA ENGINEERING

Programme	Diploma in Petrochemical Technology/Chemical Engineering				
Semester	IV		Version	1.0.0.0	
Effective from Academic Year	2026-27		Effective for the batch Admitted in		JULY 2025
Course code	1PCT4104	Course Name	Fluid flow Operation		

I.TEACHING-LEARNING AND ASSESSMENT SCHEME

Course Type	Course Code	Learning Scheme						Assessment Scheme										
		Actual Contact Hrs./Week			SLH	NLH	Credits	Theory				Practical				Based on SL		Total Marks
		CL	TL	LL				FA-TH	SA-TH	TOTAL		FA-PR	SA-PR	TOTAL		SLA		
								MAX	MAX	MAX	MIN	MAX	MAX	MAX	MIN	MAX	MIN	
DSC	1PCT4104	3	-	2	1	6	3	40	60	100	40	30	20	50	20	20	8	170

Abbreviation:	**CL-** Classroom Learning	**TL -** Tutorial Learning	**LL -** Laboratory Learning
	SLH - Self Learning Hours	**NLH -** Notional Learning Hours	**SLA -** Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam + Attendance)		**SA -** Summative Assessment

II. PRE-REQUISITES

Basic knowledge of Applied science

III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES

Measurement of flow rates of fluids by selecting the appropriate flow meter. and Select pumping devices for transportation of fluids in Petrochemical/Chemical industries.

IV. COURSE LEARNING OUTCOMES

At the end of the course, students will be able to achieve the following course learning outcomes:

CO1. Explain fundamental properties and behaviour of fluids.

CO2. Describe the effect of solid boundaries on fluid motion, including the formation of boundary layers, boundary layer separation, and wake formation.

CO3. Apply law of conservation of mass and energy to the flowing fluids.

CO4. Select the appropriate pumping device for transportation of liquids in chemical industries.

CO5. Estimate the flow rate of fluid in conduit and in open channels by using different flow meters.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:

Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Fluid Statics and its Applications	**TLO 1.1** Explain different types of fluids. **TLO 1.2** Differentiate between fluid statics and dynamics. **TLO 1.3** Explain various properties of fluids. **TLO 1.4** Classify the types of pressure. **TLO 1.5** Derive equation of pressure in static fluid **TLO 1.6** Explain manometers and derive equation of pressure	**1.1** Definition of fluid and explain its types. **1.2** Fundamentals of fluid statics and dynamics **1.3** Define Mass density, specific weight, Specific gravity, Viscosity, Surface tension, Capillarity, Compressibility and Bulk modulus. Simple numerical on properties of fluids. **1.4** Definitions of pressure concept, Static head, Static pressure, Gauge pressure, Absolute pressure, Dynamic pressure,	**10**	**07**

	difference	Total pressure, Vacuum (negative pressure) **1.5** Derivation of equation of pressure in static fluid. **1.6** Principle construction and working of Manometers with equation of pressure difference - Simple U tube manometer, Inclined manometer, Piezometer, Two fluid manometer, Micro- manometer		
Unit-2 **Fluid–Flow Phenomena**	**TLO 2.1** Explain velocity change across cross section **TLO 2.2** Explain effect of solid boundary **TLO 2.3** Define steady state and unsteady state conditions **TLO 2.4** Describe types of fluid flow **TLO 2.5** Classify fluids **TLO 2.6** Describe Reynold's experiment	**2.1.**Velocity field, velocity gradient, shear stress and rate of shear **2.2.**Boundary layer, it's separation and wake formation **2.3.**Steady state and unsteady state conditions **2.4.**Classification of fluids: Newtonian and Non-Newtonian with examples **2.5.**Types of fluid flow **2.6.**Reynold's experiment and Reynolds number, turbulent flow, laminar flow, transition flow	**8**	**5**
Unit-3 **Basic Equations of Fluid Flow**	**TLO 3.1** Define velocities **TLO 3.2** Derive continuity equation **TLO 3.3** Derive Bernoulli's equation and explain corrections **TLO 3.4** Use Hagen-Poiseuille's Equation	**3.1.**Average velocity and mass velocity **3.2.**Continuity equation for mass balance in steady flow **3.3.**Bernoulli's equation and corrections in Bernoulli's equation like kinetic energy correction, correction for fluid friction, correction for Pump work **3.4.**Hagen-Poiseuille's Equation	**14**	**11**
Unit-4 **Transportation of fluid**	**TLO 4.1** Compare pipe and tube **TLO 4.2** Sketch the different pipe fittings **TLO 4.3** Select the suitable valve based on the requirements. **TLO 4.4** Classify the pumps for handling fluid **TLO 4.5** Describe the construction of Centrifugal pump, reciprocating and rotary pump. **TLO 4.6.** Explain characteristics of centrifugal pump **TLO 4.7** Explain	**4.1** Introduction of pipe and tube **4.2** Types and uses of fittings and joints **4.3** Construction and working of various types of valves like (a) Gate valve (b) Globe valve (c) Check valves (d) Control valve **4.4** Classification of pumps **4.5** Construction and working of centrifugal, reciprocating and rotary pump **4.6** Characteristic curves of Centrifugal pump **4.7** Numerical based on NPSH, efficiency, head and power **4.8** Construction, working and uses of Compressor, Fan, Blower,	**14**	**10**

	construction, working and uses of fluid moving machineries **TLO 4.8** Explain the concept of fluidization.	Vacuum pump and Jet ejectors **4.9** Fluidization: Basic concept, minimum fluidization velocity and applications		
Unit-5 **Flow Measurement**	**TLO 5.1** Classify flow measuring devices **TLO 5.2** Explain flow meters **TLO 5.3** Derive equation of flow rate **TLO 5.4** Measure the flow rate of process fluid in open channels by using notches and weirs. **TLO 5.5** Solve simple numerical	**5.1.**Classification of flow measuring **5.2.**Construction, working principles and application of flow meters like Rota meter, Orifice meter, Venturi meter, Pitot tube, Coriolis meter, Magnetic meter, Ultrasonic meter **5.3.**Derivation of equation of flow rate through Orifice meter, Venturi meter, Pitot tube **5.4.**Measurement of flow rate of fluids in open channels: - Notches and weirs: classification, construction, principle, working derivation for discharge over Rectangular, Triangular, Trapezoidal notch or weir **5.5.**Simple numerical problems based on above topics.	**14**	**12**

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL

Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	**LLO 1.1** Measure fluid properties using standard laboratory equipment and demonstrate various fluid properties.	Demonstrate various fluid properties.	CO1
2	**LLO 2.1** Calculate absolute and kinematic viscosity using Oswald viscometer	Measure absolute and kinematic viscosity using Oswald viscometer	CO1
3	**LLO 3.1** Predict the nature of flow of fluid flowing through a pipe and calculate Reynold's Number	Identify types of flow by using Reynold's apparatus	CO2
4	**LLO 4.1** Verify Bernoulli's theorem experimentally by measuring pressure head, velocity head, and datum head along a flow system.	Verify Bernoulli's theorem.	CO1 CO3
5	**LLO 5.1** Measure and analyze fluid discharge using a venturi meter and validate experimental results with theoretical flow equations.	Measure Flow through pipe using venturi meter.	CO1 CO5
6	**LLO 6.1** Measure and evaluate fluid discharge using an orifice meter and compare experimental results with theoretical flow equations.	Measure flow through pipe using orifice meter	CO1 CO5

7	**LLO 7.1** Measure and analyze the discharge of fluid using a V-notch/ Rectangular weir and correlate experimental results with theoretical equations.	Measure flow through open channel using V-notch /Rectangular notches	CO1 CO5
8	**LLO 8.1** Determine major and minor head losses in pipe flow using experimental data and compare them with theoretical predictions.	Determine major and minor head loss Through pipes.	CO3
9	**LLO 9.1** Conduct performance testing of a centrifugal pump as per BIS standards and evaluate its operating characteristics.	Perform testing of centrifugal pump as Per bis.	CO4
10	**LLO 10.1** Determine performance characteristics of reciprocating pumps.	Perform testing of reciprocating pump as Per bis.	CO4
11	**LLO 11.1** Measure and analyze pump performance parameters and prepare a troubleshooting chart of Centrifugal pump.	Find faults and remedies for centrifugal Pump. Prepare trouble shooting chart of Centrifugal pump.	CO4

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Prepare a model of Double pipe heat exchanger, Shell and tube heat exchanger.
- Visit any nearby industry/Plant and Prepare a report on heat transfer equipment used in the industry/Plant.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1	Different manometers.
2	Various mechanical pressure gauges
3	Experimental setup of Bernoulli's Theorem
4	Experimental setup of Venturi meter, Orifice meter, rota meter assembly for fluid flow measurement.
5	Experimental setup of notch
6	Hydraulic test rig of Friction through Pipes, Fittings and Valves setup
7	Centrifugal pump test rig
8	Reciprocating pump test rig
9	Reynolds's experiment test rig.
10	Oswald viscometer and stopwatch

IX. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	Unit Operations of Chemical Engineering	McCabe, Warren L., Julian C. Smith	McGraw Hill Publication, New York 2004 (Seventh Edition)
2	Introduction to Chemical Engineering	L.Badger, Julius T. Banchero	McGraw Hill Publication, New York 2004 (Seventh Edition)
3	Unit Operations of Chemical Engineering Vol-I	P.Chattopadhyay,	Khanna Prakashan, New Delhi, 1996

4	A Textbook of Fluid Mechanic sand Hydraulic Machines	R. K. Bansal	Laxmi Publications ISBN: 9788131808153,8131808157
5	Hydraulics, Fluid Mechanics and Hydraulic Machines	R. S. Khurmi, N Khurmi	S. Chand Limited ISBN: 9788121901628,8121901626
6	Fluid flow operations	K. A. Gavhane	Nirali Prakashan

X. LINK OF LEARNING WEB RESOURCE	
1	https://nptel.ac.in/courses/105101082
2	http://www.nzifst.org.nz/unitoperations/flfltheory.htm
3	http://books.google.co.in/books?id=K4almhE5BoAC&pg=PP1&lpg=PP4&ots=1XDNGSxMsY&dq=Unit+Operation-1+nirali+Prakashan+published+year
4	http://www.chemicalprocessing.com/whitepapers/fluid-handling/
5	https://nptel.ac.in/courses/11210411
6	https://me.iitp.ac.in/Virtual-Fluid-Laboratory

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Fluid Statics and its Applications	CO1	7	3	5	2	10
2	Fluid–Flow Phenomena	CO2	5	2	5	1	8
3	Basic Equations of Fluid Flow	CO3	11	4	5	5	14
4	Transportation of fluid	CO4	10	5	8	1	14
5	Flow Measurement	CO5	12	3	5	6	14
		Grand Total	45	17	28	15	60

XII. COs AND POs AND PSOs MAPPING

Course Outcome (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	1	3	2	1
CO2	3	2	1	2	1	1	1	3	2	1
CO3	3	3	2	1	1	1	1	3	3	1
CO4	2	2	3	2	1	1	1	2	3	2
CO5	2	2	1	3	1	1	1	2	3	2

Legends: -*3- High 2-Moderate/Medium 1-Slight/Low 0-None*