Format K1

Maharashtra State Board of Technical Education, Mumbai

TEACHING PLAN (TP) Academic Year: **2025-26 (EVEN)**

Institute Code and Name: 0078- K. K. Wagh Polytechnic, Nashik **Semester**: Fourth
Programme and Code: Chemical Engineering (CH) **Course Index:** 404
Course and Code: Industrial Fluid Flow Operations(IFFO) 314310
Name of Faculty: Mrs. A. B. Shaikh **CLASS: SYCH**

INDUSTRY EXPECTED OUTCOME

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

COURSE LEVEL LEARNING OUTCOMES (COS)

- **CO404.1** - Identify the different properties of fluid used in chemical process.
- **CO404.2** - Apply law of conservation of mass and energy to the flowing fluids.
- **CO404.3**- Estimate the flow rate of fluid in conduit and in open channels by using different flow meters.
- **CO404.4** - Select the appropriate pumping device for transportation of liquids in chemical industries
- **CO404.5**- Choose the suitable pumps for transportation of gases in chemical industries.

TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs/Week			SLH	NLH			Theory				Based on LL & TSL Practical				Based on SL		
											FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
				CL	TL	LL					Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314310	INDUSTRIAL FLUID FLOW OPERATION	IFFO	DSC	4	-	4	-	8	4	03	30	70	100	40	25	10	25#	10	--	--	150

Total IKS Hrs for Sem.: 1 Hrs

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

THEORY LEARNING OUTCOME (TLO)

TLO No.	Title of TLO
TLO 1.1	Explain the different properties of fluids.
TLO 1.2	Measure the viscosity of liquid by using redwood viscometer.
TLO 1.3	Describe the principle of hydrostatic equilibrium
TLO 1.4	Measure the differential pressure by using U-tube manometer.
TLO 1.5	Determine the relationships among physical quantities with the help of dimensional analysis
TLO 2.1	State and derive the equation of continuity.
TLO 2.2	State Euler's equation of motion.
TLO 2.3	Derive the Bernoulli's equation.

TLO 2.4	Perform the Reynold's Experiment to study the different types of flows.
TLO 2.5	Evaluate the losses in pipes due to pipe fittings.
TLO 3.1	Compare the flow meters.
TLO 3.2	Describe with sketches the construction and working of different flowmeters.
TLO 3.3	Explain the relative advantages and disadvantages of different flow meters.
TLO 3.4	Measure the flow rate of process fluid in open channels by using notches and weirs.
TLO 4.1	Sketch the different pipe fittings.
TLO 4.2	Select the suitable valve based on the requirements.
TLO 4.3	Classify the pumps for handling liquids
TLO 4.4	Describe the construction of Centrifugal pump.
TLO 4.5	Explain the working of Reciprocating Pump
TLO 4.6	Explain the construction and working of Rotary Pump.
TLO 5.1	Explain principle, construction, working and application of different gas pumping devices.
TLO 5.2	Draw the sketch of vacuum generating device
TLO 5.3	Explain the concept of fluidization.

SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	**Programme Outcomes (POs)**							**Programme Specific Outcomes (PSOs)**		
	PO-1 Basic and Discipline Specific Knowledge	**PO-2 Problem Analysis**	**PO-3 Design/ Development of Solutions**	**PO-4 Engineering Tools**	**PO-5 Engineering Practices for Society, Sustainability and Environment**	**PO-6 Project Management**	**PO-7 Life Long Learning**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	3	1	-	2	2	-	2			
CO2	3	1	-	2	1	-	2			
CO3	3	2	1	2	1	1	2			
CO4	3	2	1	2	2	1	2			
CO5	3	2	1	2	2	1	2			
Legends :- High:03, Medium:02,Low:01, No Mapping: - *PSOs are to be formulated at institute level										

Maharashtra State Board of Technical Education K-1

Teaching Plan (TP)

Academic Year: 2025-26
Program: Chemical Engineering
Course: Industrial Fluid Flow Operation(IFFO)
Name of faculty: Mrs. A. B. Shaikh

Institute Code: 0078
Course Code: 314310
Semester: FOURTH (CH-4K)

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
Unit - I Fluid Properties								
1 (10)	**CO-1**	**TLO 1.1**	1.1 Introduction to fluids and it's properties: Properties of fluids: pressure, volume, density, surface tension, capillarity, viscosity Classification of fluids: • Ideal & actual fluids • Compressible & incompressible fluids • Newtonian & non-newtonian fluids Newton's law of viscosity: Statement, derivation, absolute & kinematic viscosity, Measurement of viscosity Redwood viscometer: construction and working Numericals	3	17/12/2025 To 18/12/2025		Blackboard, Books, media, PPT	
		TLO 1.2	1.2 Principle of hydrostatic equilibrium: Statement and derivation **MKCL Quiz 1**	2	20/12/2025 To 27/12/2025			

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
		TLO 1.3	1.3 Measurement of pressure: by using manometers Types : Simple U tube and U tube differential manometers, equations, simple numerical on U-tube manometer. **MKCL Quiz-2**	2	31/12/2025 To 01/01/2026			
		TLO 1.4 **TLO 1.5**	1.4analysis: Importance and Dimensional homogeneity Methods of dimensional analysis : • Rayleigh • Buckingham's pi method Method of finding dimensionless numbers, Selection of variables, Common dimensionless numbers and their physical significance Numerical **MKCL Quiz- 3, Practice Test-1**	3	01/01/2026 To 07/01/2026			
Unit - II Flow of Incompressible Fluids								
2(12)	**CO-2**	**TLO 2.1**	2.1 Equation of continuity: Statement, derivation calculation of mass flow rate, volumetric flow rate, average velocity & mass velocity.	2	08/01/2026 To 08/01/2026		Blackboard, Books, media, PPT	
		TLO 2.2	2.2. Equations of motion: Eulers's equation of motion.	2	10/01/2026 To 14/01/2026			
		TLO 2.3	2.3 Bernoulli's equation from Euler's equation for Ideal fluid: Statement,assumptions, derivation, corrections in Bernoulli's equation for real fluids Numerical **MKCL Quiz-4**	3	15/01/2026 To 17/01/2026			

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
		TLO 2.4	2.4 Reynolds experiment : Significance in determining turbulent, laminar & transition regime. Reynolds number, critical velocity Numerical	2	21/01/2026 To 22/01/2026			
		TLO 2.5	2.5 Friction in pipe: Friction Types: Form friction & skin friction, Fanning and Darcy Weisbatch friction factor, the standard friction factor chart, relation between friction factor and Reynolds number, friction losses due to sudden expansion/reduction of pipe & in pipe fittings, equivalent length of pipe, concept of Boundary layer, significance of Hagen Poiseuille equation: mathematical equation (no derivation) Numerical **MKCL Quiz-5, Practice Test-2**	3	22/01/2026 To 28/01/2026			
Unit - III Flowrate of Fluids								
3(14)	**CO-3**	**TLO 3.1**	3.1 Classification of flow measuring instruments in conduits: Based on variation in pressure drop: Principle, construction, working, derivation for calculating the flow rates/coefficient of discharge • Venturimeter • Orifice meter Numerical	3	29/01/2026 to 31/01/2026		Blackboard, Books, media, PPT	
		TLO 3.2	3.2 Classification of flow measuring instruments in conduits: based on variation in flow area: Construction, principle, working and calibration • Rotameter	3	04/02/2026 To 05/02/2026			

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
		TLO 3.3	3.3 Measurement of local velocity : Principle, construction, working, derivation for calculating the flow rates/coefficient of discharge and numerical • Pitot tube • **MKCL Quiz-6**	3	07/02/2026 to 12/02/2026			
		TLO 3.4	3.4 Advantages and Disadvantages: Venturimeter, orifice meter, rotameter and pitot tube	2	12/02/2026 To 14/02/2026			
		TLO 3.5	3.5 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 numerical **MKCL Quiz-7, Practice Test-3**	3	18/02/2026 To 25/02/2026			
Unit - IV Transportation of Liquids								
4(14)	**CO-4**	**TLO 4.1**	4.1 Pipe and its fittings: Necessity in industry, material of construction, difference in pipes and tubes, Schedule number, Birmingham Wire Gauge, different types of pipe fittings with sketches.	2	26/02/2026 To 28/02/2026		Blackboard, Books, media, PPT	
		TLO 4.2	4.2 Valves: Construction, working and applications of • Gate valve • Globe valve • Butterfly valve • Needle valve • Ball valve • Safety valve • Rupture disc	3	04/03/2026 to 05/03/2026			**1 extra**

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
		TLO 4.3	4.3 Types of pumps used for handling liquids: Necessity, broad Classification, factors considered for selection of pump. **MKCL Quiz-8**	2	07/03/2026 to 11/03/2026			
		TLO 4.4	4.4 Centrifugal pump: Principle, construction, working, cavitation, air binding, priming of pump, Net Positive Suction Head (NPSH), characteristics curve, derivation for power requirement, head developed and mechanical efficiency, advantages and disadvantages Numerical	2	12/03/2026 To 12/03/2026			
		TLO 4.5	4.5 Positive Displacement Reciprocating Pump: Principle, classification: construction, working, derivation of power required, mechanical efficiency. Numerical • Single and double acting pump • Piston and Plunger	3	14/03/2026 To 19/03/2026			
		TLO 4.6	4.6 Positive Displacement Rotary Pump: Principle, construction and working of Mono/Screw and Gear pump **MKCL Quiz-9, Practice Test-4**	2	19/03/2026 To 21/03/2026			
Unit - V Pumping of Gases								
5(10)	**CO-5**	**TLO5.1**	5.1 Gas pumping and devices: Need of pumping devices in industries and concept of interstage cooling.	2	25/03/2026 To 26/03/2026		Blackboard, Books, media, PPT	
		TLO 5.1	5.2 Fans: Construction, working and applications of • Induced and forced draft Fans, • Axial and centrifugal Fans	2	26/03/2026 To 28/03/2026			

Chap No. (Alloted Hrs.)	CO Mention only Number	TLO Mention only Number	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
		TLO 5.2	5.3 Blowers: Construction, working and applications of • Reciprocating & centrifugal blower **MKCL Quiz-10**	1	01/04/2026			
		TLO 5.2	5.4 Compressors: Construction, working and applications of • Reciprocating & centrifugal compressors	1	02/04/2026			
		TLO 5.3	5.5 Vacuum pump: • Steam Jet ejectors,principle,construction,working and applications	2	02/04/2026 To 04/04/2026			
		TLO 5.3	5.6 Fluidization: Basic concept, minimum fluidization velocity and applications **MKCL Quiz-11, Practice Test-5**	2	04/04/2026 to 04/04/2026			

ASSESSMENT METHODOLOGIES/TOOLS

A. Formative assessment (Assessment for Learning)

- Two Term Test Examination of 30 Marks.
- Term Work Assessment 25 Marks.

B. Summative Assessment (Assessment of Learning)

- End Term Theory Examination of70 Marks.
- End Term Practical Examination 25 Marks.

SUGGESTED LEARNING MATERIALS / BOOKS

Sr. No.	Author	Title of Book	Publication
1	R. K. Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi Publications ISBN: 9788131808153, 8131808157
2	Robert W. Fox, Alan T. McDonald, Philip J. Pritchard	Introduction to fluid mechanics	Wiley ISBN: 9780470234501, 0470234504
3	Warren McCabe, Julian Smith, Peter Harriott	Unit Operations of Chemical Engineering	McGraw-Hill Education ISBN: 9780072848236, 0072848235
4	Shiv Kumar	Fluid Mechanics (Vol. 2) Basic Concepts and Principles	Springer International Publishing ISBN: 9783030997540, 3030997545
5	Paul J. LaNasa, E. Loy Upp	Fluid Flow Measurement A Practical Guide to Accurate Flow Measurement	Elsevier Science ISBN: 9780124095328, 0124095321
6	Franz Durst	Fluid Mechanics An Introduction to the Theory of Fluid Flows	Springer ISBN: 9783540713425, 3540713425
7	Jamal Mohammed Saleh	Fluid Flow Handbook	McGraw-Hill Companies,Incorporated ISBN: 9780071363723, 0071363726
8	R. Peter King	Introduction to Practical Fluid Flow	Elsevier Science ISBN: 9780080495842, 0080495842
9	R. K. Singal	Hydraulic Machines: Fluid Machinery	I.K. International Publishing House Pvt. Limited ISBN: 9789380026015, 9380026013
10	R. S. Khurmi, N Khurmi	Hydraulics, Fluid Mechanics and Hydraulic Machines	S. Chand Limited ISBN: 9788121901628, 8121901626

LEARNING WEBSITES & PORTALS

Sr. No	Link / Portal	Description
1	https://nptel.ac.in/courses/105101082	(Videos and Texts) Fluid Mechanics, IIT Bombay
2	https://archive.nptel.ac.in/courses/112/106/112106200/	(Videos and Texts) Fluid Dynamics and Turbomachines, IIT Madras

Sr. No	Link / Portal	Description
3	https://archive.nptel.ac.in/courses/112/105/112105269/	(Videos and Texts) Introduction to Fluid Mechanics, IIT Kharagpur
4	https://nptel.ac.in/courses/112104118	(Videos and Texts) Fluid Mechanics, IIT Kanpur
5	https://nptel.ac.in/courses/103104044	(Videos and Texts) Fluid Mechanics, IIT Kanpur
6	https://nptel.ac.in/courses/105103192	(Videos and Texts) Fluid Mechanics, IIT Guwahati

Note : Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Mrs. A. B. Shaikh
(Name & Signature of Staff)

Dr. P. S. Bhandari
(Name & Signature of HOD)