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**: Second
Programme and Code: Chemical Engineering (CH) **Course Index: 202**
Course and Code: Solid Fluid Operations (SFO) and 312342
Name of Faculty: Mrs. J. H. Nihalani **CLASS: FYCH**

INDUSTRY EXPECTED OUTCOME

The aim of this course is to help the student to attain the industry identified competency through various teaching learning experiences:

COURSE LEVEL LEARNING OUTCOMES (COS)

- CO202.1 - Use different size reduction equipment such as Jaw crusher, Hammer mill, Ball mill etc. in given chemical process industry.
- CO202.2 - Use the relevant separation methods for solid-solid separation.
- CO202.3 - Select the relevant method for solid-liquid separations.
- CO202.4 - Select the appropriate method to separate gas-solid mixture.
- CO202.5 - Apply the knowledge of mixing/agitation in given chemical process industry.

TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category	Learning Scheme					Credits	Paper Duration	Assessment Scheme										
				Actual Contact Hrs/Week			SLH	NLH			Theory				Based on LL & TSL Practical				Based on SL		Total Marks
											FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
				CL	TL	LL					Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312342	Solid Fluid Operations	SFO	DSC	4	-	4	2	10	5	03	30	70	100	40	50	20	25@	10	25	10	200

Total IKS Hrs for Sem.:0 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	Describe with sketches the relevant measurement technique for the given solid particle.
TLO 1.2	Calculate the power requirement for size reduction of given solid particle.
TLO 1.3	Describe the construction & working of given size reduction equipment.
TLO 1.4	Enlist the factors affecting the size reduction of the given solid.
TLO 1.5	Explain different types of conveyor in various chemical industries.

TLO 2.1	Describe the cumulative and differential analysis method for screening
TLO 2.2	Identify the relevant equipment for screening operation
TLO 2.3	Describe with sketches the process of flotation for the given mixture.
TLO 2.4	Describe with sketches the Electromagnetic separation for the given system of mixture
TLO 3.1	Apply principle of Filtration for separation in given chemical industry.
TLO 3.2	Apply the principle of centrifugation for given mixture
TLO 3.3	Perform batch sedimentation test for given operation.
TLO 3.4	Explain working of relevant sedimentation equipment
TLO 4.1	Describe with sketches the construction &working of cyclone separator for given gas-solid mixture.
TLO 4.2	State principle and applications of Electrostatic separator.
TLO 4.3	Explain with sketches working of Fabric filter for given gas-solid mixture
TLO 4.4	Identify relevant wet scrubbers for the given gas-solid mixture.
TLO 4.5	Describe gravity settling tank for separation in given chemical industry.
TLO 5.1	Explain importance of mixing & agitation.
TLO 5.2	Compute the mixing index for given system.
TLO 5.3	Draw the various flow patterns such as radial, axial.
TLO 5.4	Describe the concept of swirling & vortexing.

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**
CO1	2	2	2	1	2	1	2	3	3
CO2	2	2	1	1	2	1	2	3	3
CO3	2	2	1	2	2	1	2	3	3
CO4	2	2	1	2	2	1	3	3	3
CO5	2	2	1	2	2	1	2	3	3

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: 2024-25
Program: Chemical Engineering
Course: Solid Fluid Operations (SFO)
Name of faculty: Mrs. J. H. Nihalani

Institute Code: 0078
Course Code: 312342
Semester: Second (CH-2K)

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 Solid Particle and Size reduction								
1 (14)	**CO-1**	**TLO 1.1**	1.1 Characterization of Solids: Particle shape, size. Concept of Sphericity.	2	15/12/2025 to 16/12/2025		Blackboard, Books, media, PPT	
		TLO 1.2	1.2 Size Reduction : Importance of size reduction, factors affecting on size reduction. Kick's Law, Rittinger's law, Bond's law, Work index, Crushing efficiency & power consumption. Numerical.	3	17/12/2025 to 22/12/2025			
		TLO 1.3	1.3 Classification of size reduction equipment. Concept of open & closed circuit grinding. **MKCL Quiz 1**	2	23/12/2025 to 24/12/2025			
		TLO 1.4	1.4 Size reduction equipment: Principle, construction & working of Jaw crusher, Gyratory crusher, Roll mill. Grinder: Hammer mill, Ball mil (Concept of Critical speed of Ball mill with derivation) Numerical.	5	29/12/2025 to 05/01/2026			
		TLO 1.5	1.5 Conveyor: Importance of conveyor, Belt conveyor,	2	06/01/2026 to			

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
			Chain conveyor, Screw conveyor & Pneumatic conveyor.		07/01/2026			
		---	**MKCL Quiz 2 and Practice Test 1**	1	08/01/2026			
Unit - II Solid-solid Separation								
2(12)	**CO-2**	**TLO 2.1**	2.1 Screening: Concept of operation, Mesh Number, Oversize and undersize particle, cut diameter, Ideal and Actual screen	2	12/01/2026 to 13/01/2026		Blackboard, Books, media, PPT	
		TLO 2.2	2.2 Types of standard Screen Series: Tyler standard screen series, Indian standard screen series, Capacity and Screen Efficiency, Types of screen analysis: Differential and cumulative. Factors affecting screening operation.	4	14/01/2026 to 20/01/2026			
		TLO 2.3	2.3 Screening Equipment: Concept & operation i) Vibrating screens ii)Flip Flow screens iii)Gyratory screens **MCKL Quiz 3**	3	20/01/2026 to 22/01/2026			**1 extra**
		TLO 2.4	2.4FrothFlotation: Mechanism, floating agents, Industrial floating equipment.	2	27/01/2026 to 28/01/2026			
			2.5 Electromagnetic separation: Magnetic Drum separator Principle, construction, working, industrial application	2	29/01/2026 to 02/02/2026			**1 extra**
		---	**MKCL Quiz 4 and Practice Test 2**	1	02/02/2026			
Unit III Solid-Liquid Separation								
3(16)	**CO-3**	**TLO 3.1**	3.1 Filtration: Principle, Types, Factors affecting filtration rate, filter aid ,filter media	4	03/02/2026 to 05/02/2026		Blackboard, Books, media, PPT	
		TLO 3.2	3.2 Types of filtration equipments a) Primary filter – Sand filter (pressure sand filter and rapid sand filter) b) Pressure filters – Plate & frame filter press (Washing type & Non	4	09/02/2026 to 12/02/2026			

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
			washing type) c) Vacuum filter – Rotary drum filter d) Centrifugal filter – Basket **MKCL Quiz 5**					
		TLO 3.3	3.3 Sedimentation: Concept, Free and Hindered settling velocity, Batch sedimentation test, Factors affecting the rate of sedimentation	4	16/02/2026 to 19/02/2026			
		TLO 3.4	3.4 Dorr Thickener, Clarifier, Settling Tank: Principle, Construction and Working.	4	23/02/2026 to 26/02/2026			
		---	**MKCL Quiz 6 and Practice Test 3**	1	26/02/2026			**1 extra**
Unit - IV Solid-Gas Separation								
4(08)	**CO-4**	**TLO 4.1**	4.1 Cyclone separator: Principle, construction, working &industrial applications	1	02/03/2026		Blackboard, Books, media, PPT	
		TLO 4.2	4.2 Electrostatic separator: Principle, construction, working & industrial applications	2	03/03/2026 to 05/03/2026			
		TLO 4.3	4.3 Fabric filter: Principle, construction & working, & industrial applications **MKCL Quiz 7**	1	09/03/2026			
		TLO 4.4	4.4 Wet scrubber (Simple wet scrubber, Venturi scrubber): Principle, construction & working, & industrial applications	2	10/03/2026 to 11/03/2026			
		TLO 4.5	4.5 Gravity settling Tank: Principle, construction & working.	2	12/03/2026 to 16/03/2026			
		---	**MKCL Quiz 8 and Practice Test 4**	1	16/03/2026			**1 extra**
Unit - V Mixing of Solids and Fluids								

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
5(10)	**CO-5**	**TLO5.1**	5.1 Importance of mixing & agitation: Principle of mixing.	3	17/03/2026 to 19/03/2026		Blackboard, Books, media, PPT	
		TLO 5.2	5.2 Criteria for selection of agitator: Propeller, turbine, paddles.	2	23/03/2026 to 24/03/2026			
		TLO 5.3	5.3 Concept of swirling & vortex: Methods of prevention of swirling & vortex formation **MKCL Quiz 9**	2	24/03/2026 to 25/03/2026			
		TLO 5.4	5.4 Mixers: Concept of mixing index. Principle, construction & working of Sigma mixer, Ribbon blender.***Case Study of any food industry using various Mechanical Unit Operations and Equipment (Beyond Syllabus)**	3	30/03/2026 to 31/03/2026			
		---	**MKCL Quiz 9 and Practice Test 5**	1	31/03/2026			**1 extra**

ASSESSMENT METHODOLOGIES/TOOLS

A. Formative assessment (Assessment for Learning) (FA-TH)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering
  - 60% weightage is to process
  - 40% weightage to product

B. Summative Assessment (Assessment of Learning) (SA-TH)

- Continuous Assessment based on Process and Product related performance indicators. Each practical will be assessed considering
  - 60% weightage to Process
  - 40% weightage to Product

SUGGESTED LEARNING MATERIALS / BOOKS

Sr. No.	Author	Title of Book	Publication
1	Unit Operations of Chemical Engineering	McCabe W. L. Smith Julian C. Harriot Peter	McGraw Hill International; 2010; ISBN: 007-124710-6
2	Introduction to Chemical Engineering	Ghosal S. K., Sanyal Shyamal K., Datta S.	Tata McGraw Hill Publications; 2006;ISBN: 0-07-460140-7
3	Unit Operations of Chemical Engineering	Walter L. Badger, Julius T. Banchero	McGraw Hill International, 1955; ISBN: 9780070850279
4	Mechanical Operations	Swain Anup K., Patra Hemlata, Roy G. K.	McGraw Hill Publication; 2010; ISBN-10: 0070700222
5	Fundamentals of Chemical Engineering	S.N. Saha	Dhanpat Rai Publishing Co. New Delhi, 2012, ISBN:81-87433-55-8

LEARNING WEBSITES & PORTALS

Sr. No	Link / Portal	Description
1	https://www.youtube.com/watch?v=ldhRvlU1G70&t=21s	Working of Ball Mill
2	https://www.youtube.com/watch?v=-BHmsjvnm_4	Working of Hammer Mill
3	https://www.youtube.com/watch?v=EfTcfQY4kEY	Working of Plate & Frame filter
4	https://www.youtube.com/watch?v=npiTNdapr7w	Working of Conveyor
5	https://www.youtube.com/watch?v=fHj8djUc3og	Description of Cyclone separator
6	https://www.youtube.com/watch?v=fHj8djUc3og	Froth Flotation Process
7	https://www.youtube.com/watch?v=N2f5X1wkbvQ	Different types of Mill
8	https://www.youtube.com/watch?v=e0i3mxc79yI	Sigma Blade Mixer

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. J. H. Nihalani
(Name & Signature of Staff)

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