Maharashtra State Board of Technical Education, Mumbai

K-2

LABORATORY PLAN (LP)

Academic Year: 2026-27

Date: 27/06/2026

Institute Name & Code: K. K. Wagh Polytechnic, Nashik-3 (0078) Class: SYCH

Program and Code: Chemical Engineering (CH) Course Index: CO301

Course Name: Process Calculations Course Code &. Abbr.: 313336(PCAL)

Total Hrs: 30 Semester: III[rd] Scheme: K Name of Faculty: Mrs. J. H. Nihalani

- **INDUSTRY EXPECTED OUTCOME**

Compute the mass and energy balances for a certain unit operation and chemical process reactions. Determine the quantity and composition of the input and output streams from the operation/process.

- **COURSE LEVEL LEARNING OUTCOMES (COS)**

- CO301.1 - Apply the gas law for different chemical engineering operations and processes
- CO301.2 - Estimate requirement of materials for a unit operation using law of conservation of mass
- CO301.3 - Compute material balances for processes with chemical reactions
- CO301.4- Calculate heat of reaction for a given chemical process
- CO301.5- Calculate the calorific value of fuel to justify its quality.

- **TEACHING AND EXAMINATION SCHEME:**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										
				Actual Contact Hrs/Week			SLH	NLH			Theory				Based on LL & TSL Practical				Based on SL		Total Marks
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313340	Process Calculation	PCAL	DSC	4	2	-	-	6	3	03	30	70	100	40	50	20	--	--	--	--	150

Abbreviations: CL- Class Room 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

- **LABORATORY LEARNING OUTCOME (LLO)**

LLO No.	Title of LLO
LLO 1.1	Convert units among different systems.
LLO 2.1	Apply ideal gas law for gas and gaseous mixture
LLO 3.1	Use average molecular weight and estimate the density of gaseous mixture.
LLO 4.1	Use law of conservation of mass to determine material balance of given unit operation
LLO 5.1	Draw block diagram for given unit operation
LLO 6.1	Use law of conservation of mass to calculate the quantity of raw materials for the given unit Operation at steady state condition.
LLO 7.1	Use of DWSIM to determine material balance of given unit operation
LLO 8.1	Write balanced chemical reaction
LLO 8.2	Identify limiting and excess reactant for given reaction system
LLO 9.1	Calculate % excess reactant for the given chemical reaction
LLO 10.1	Calculate composition of product or reactant stream for a given chemical process
LLO 11.1	Calculate mean heat capacity of gas and heat capacity of gaseous mixture
LLO 12.1	Apply Hess law to calculate heat of formation of a given compound
LLO 13.1	Calculate heat of reaction for a given chemical process

LLO 14.1	Enlist types of fuel used for combustion process
LLO 14.2	Calculate calorific value of given fuel
LLO 15.1	Calculate amount of air for combustion of given fuel
LLO 15.2	Calculate composition of flue gases for given combustion process

- **COS, PRACTICAL LABORATORY LEARNING OUTCOME (LLOS) AND MAPPING:**

PR. No	Relevant COs	Practical Laboratory Learning Outcome (LLO)	Practical Titles	Planned Date		Actual Date Of Completio	Remark/ Assess-ment Date Staff sign
				From	To		
1	CO1	LLO 1.1	Numerical based on conversion of units of physical quantity among SI, MKS, CGS and FPS system.	A-04/07/2026 B-03/07/2026 C-03/08/2026	A-04/07/2026 B-03/07/2026 C-03/08/2026		
2	CO1	LLO 2.1	Numerical using ideal gas law, Dalton's law, Amagat's law and Raoult's law.	A-11/07/2026 B-10/07/2026 C-10/08/2026	A-11/07/2026 B-10/07/2026 C-10/08/2026		
3	CO1	LLO 3.1	Numerical on calculation of average molecular weight, average density, and composition of gas in mol and wt %.	A-18/07/2026 B-17/07/2026 C-17/08/2026	A-18/07/2026 B-17/07/2026 C-17/08/2026		
4	CO1 CO2	LLO 4.1	Numerical on material balance of unit operation such as distillation/ evaporation/drying at steady state condition	A-25/07/2026 B-24/07/2026 C-24/08/2026	A-25/07/2026 B-24/07/2026 C-24/08/2026		
5	CO1 CO2	LLO 6.1	Numerical on material balance of unit operation such as mixing, blending, filtration and crystallization at steady state	A-01/08/2026 B-31/07/2026 C-31/08/2026	A-01/08/2026 B-31/07/2026 C-31/08/2026		
6	CO1 CO2 CO3	LLO 8.1 LLO 8.2	Numerical on material balance involving chemical reaction to calculate stoichiometric ratio, limiting and excess reactant	A-08/08/2026 B-07/08/2026 C-07/09/2026	A-08/08/2026 B-07/08/2026 C-07/09/2026		
7	CO1 CO2 CO3	LLO 9.1	Numerical on calculation of % excess reactant for the given chemical reaction	A-22/08/2026 B-14/08/2026 C-07/09/2026	A-22/08/2026 B-14/08/2026 C-07/09/2026		
8	CO1 CO2 CO3	LLO 10.1	Numerical on calculation of composition of product or reactant stream	A-29/08/2026 B-21/08/2026 C-21/09/2026	A-29/08/2026 B-21/08/2026 C-21/09/2026		
9	CO1 CO3 CO4	LLO 13.1	Numerical on standard heat of reaction using heat of formation and heat of combustion data	A-05/09/2026 B-04/09/2026 C-28/09/2026	A-05/09/2026 B-04/09/2026 C-28/09/2026		
10	CO5	LLO 14.1	Numerical on gross and net calorific value for the given fuel	A-12/09/2026 B-11/09/2026 C-28/09/2026	A-12/09/2026 B-11/09/2026 C-28/09/2026		
11	CO1 CO4	LLO 11.1	Numerical on calculation of heat Capacities for gas and gaseous mixture	A-19/09/2026 B-18/09/2026 C-05/10/2026	A-19/09/2026 B-18/09/2026 C-05/10/2026		
12	CO1 CO5	LLO 15.1 LLO 15.2	Numerical on requirement of air and composition of flue gases for combustion process	A-26/09/2026 B-25/09/2026 C-05/10/2026	A-26/09/2026 B-25/09/2026 C-05/10/2026		
13	-----	-----	Practical/Tutorial Beyond Syllabus	A-03/10/2026 B-09/10/2026 C-12/10/2026	A-03/10/2026 B-09/10/2026 C-12/10/2026		

- **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

- **LABORATORY EQUIPMENT/INSTRUMENTS/ TOOLS / SOFTWARE REQUIRED**

Sr. No.	Equipment Name with Broad Specifications	Relevant LLO Number
1	DWSIM Software (Open Source)	7

- **SUGGESTED LEARNING MATERIALS / BOOKS**

Tim	Author	Title of Book	Publication
1	B. I. Bhatt, ShuchenB. Thakore	Stoichiometry	McGraw Hill, 2010, ISBN: 9780070681149,0070681147
2	Himmelblau David M.and Riggs	Basic Principle and Calculations in Chemical Engineering	Prentice Hall, 2012, ISBN: 9780132346603,0132346605
3	Hougen and Watson	Chemical Process Principles	Wiley Eastern Ltd., New Delhi, 2004, ISBN13:9798123909539
4	S.K. Ghoshal, S.K.Sanyal, S. Datta	Introduction to Chemical Engineering	Tata McGraw Hill Education Private Limited, ISBN: 9780074601402, 0074601407
5	Felder R. M. andRousseau R. W.	Elementary Principles of Chemical Processes	Wiley, 2020, ISBN: 9781119498636,1119498635

- **LEARNING WEBSITES & PORTAL**

Sr. No	Link / Portal	Description
1	https://www.msubbu.in/sp/pc/	Solved Numerical in Process Calculation
2	https://unacademy.com/goal/gate-ese/QGFRK/freeplatform/chem	Video Lectures
3	https://archive.nptel.ac.in/courses/103/105/103105209/	Video Lectures, Transcripts
4	https://dwsim.org/	DWSIM Open Source Software

Mrs. J. H. Nihalani
(Name & signature of staff)

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