Maharashtra State Board of Technical Education, Mumbai

K-2

LABORATORY PLAN (LP)

Academic Year: 2025-26

Date: 10/12/2025

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

Program and Code: Chemical Engineering (CH) Course Index: CO406

Course Name: Pollution Control in Chemical Industries Course Code &. Abbr.: 314311(PCCI)

Total Hrs: 30 Semester: 4th Scheme: K Name of Faculty: Mrs. Y. S. Kumawat

- **INDUSTRY EXPECTED OUTCOME**

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

• Apply pollution control methods to mitigate different types of pollution in the chemical industries

- **COURSE LEVEL LEARNING OUTCOMES (COS)**
- **CO406.1:** Use relevant equipment for the control of air pollution in chemical process industries
- **CO406.2:** Select the appropriate treatment method required for treating chemical industrial wastewater
- **CO406.3:** Select appropriate disposal method for given chemical industrial solid waste.
- **CO406.4:** Apply relevant treatment method for managing given hazardous waste
- **CO406.5:** Apply pollution control act to control pollution in chemical industry

- **Teaching and Examination Scheme:**

Course Code	Course Title	Abbr	Course Category/s	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	
314311	**POLLUTIONCONTROLINCHEMICALINDUSTRIES**	PCCI	DSC	4	-	**2**	2	8	4	03	30	70	100	40	25	10	25#	10	25	10	175

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	Use high volume sampler to measure particulate pollutant
LLO 1.2	Explain the impact of particulate pollutant on the environment.
LLO 2.1	Use orsat apparatus to determine composition of flue gases
LLO 2.2	Explain the impact of flue gases on the environment
LLO 3.1	Use pollution under control kit to measure pollutant concentration.
LLO 4.1	Use Kjeldahl apparatus to determine total nitrogen content in waste water.
LLO 4.2	Explain the impact of nitrogen level in water.
LLO 5.1	Perform titration to determine chloride content in wastewater.
LLO 5.2	Explain the impact of chloride level in water.
LLO 6.1	Use TDS meter to determine total dissolved solids in wastewater.
LLO 6.2	Explain the impact of TDS level in water.
LLO 7.1	Use DO meter to determine dissolved oxygen in wastewater
LLO 7.2	Explain the importance of dissolved oxygen in water
LLO 8.1	Use COD apparatus to determine Chemical Oxygen Demand of the given effluent sample

LLO No.	Title of LLO
LLO 8.2	Explain the concept of Chemical Oxygen Demand
LLO 9.1	Use BOD apparatus to determine Biological Oxygen Demand of the given effluent sample.
LLO 9.2	Explain the concept of Biological Oxygen Demand
LLO 10.1	Use turbidity meter to measure turbidity of given wastewater sample.
LLO 12.1	Perform titration to determine the neutralization point of waste water.
LLO 13.1	Calculate density of given solid waste by using weighing balance.
LLO 14.1	Use specific gravity bottle to determine density of hazardous waste
LLO 16.1	Use CPCB online monitoring system for analysis of air quality index of various cities.

- **COs, Practical Laboratory Learning Outcome (LLOs) and Mapping:**

PR. No	Relevant COs	Practical - Laboratory Learning Outcome (LLO)	Name of Experiments/Assignment/ Sheet/ Job/ Project Activity	Planned Dates		Actual Date of conduction	Remark / Assess-ment Date with Staff sign
				From	To		
1	CO1	LLO 1.1 LLO 1.2	* Measurement of particulate pollutants using High Volume Sampler.	A-25/02/26	A-04/03/26		
				B-26/02/26	B-05/03/26		
				C-27/02/26	C-06/03/26		
2	CO1	LLO 2.1 LLO 2.2	*Determination of total nitrogen content in wastewater using kjeldahal apparatus.	A-04/03/26	A-11/03/26		
				B-05/03/26	B-12/03/26		
				C-06/03/26	C-13/03/26		
3	CO1	LLO 3.1	*Determination of chloride content in wastewater.	A-07/01/26	A-14/01/26		
				B-08/01/26	B-15/01/26		
				C-09/01/26	C-16/01/26		
4	CO1	LLO 4.1 LLO 4.2 .	*Determination of total dissolved solids in wastewater.	A-14/01/26	A-21/01/26		
				B-15/01/26	B-22/01/26		
				C-16/01/26	C-23/01/26		
5	CO2	LLO 5.1 LLO 5.2	Determination of dissolved oxygen in wastewater.	A-21/01/26	A-28/01/26		
				B-22/01/26	B-29/01/26		
				C-23/01/26	C-30/01/26		
6	CO2	LLO 6.1 LLO 6.2	Determination of Chemical Oxygen Demand of the given effluent sample.	A-28/01/26	A-04/02/26		
				B-29/01/26	B-05/02/26		
				C-30/01/26	C-06/02/26		
7	CO2	LLO 7.1	*Determination of Biological Oxygen Demand of the given effluent sample.	A-04/02/26	A-11/02/26		
				B-05/02/26	B-12/02/26		
				C-06/02/26	C-13/02/26		

PR. No	Relevant COs	Practical - Laboratory Learning Outcome (LLO)	Name of Experiments/Assignment/ Sheet/ Job/ Project Activity	Planned Dates		Actual Date of conduction	Remark / Assess-ment Date with Staff sign
8	**CO3**	**LLO 9.1 LLO 9.2**	*Measurement the turbidity of given wastewater sample.	A-11/02/26	A-18/02/26		
				B-12/02/26	B-19/02/26		
				C-13/02/26	C-20/02/26		
9	**CO4**	**LLO 10.1**	*Determination of neutralization point for charcoal treatment of acidic wastewater.	A-18/02/26	A-25/02/26		
				B-19/02/26	B-26/02/26		
				C-20/02/26	C-27/02/26		
10	**CO4**	**LLO 12.1**	* Determination of density of solid waste.	A-17/12/25	A-24/12/25		
				B-18/12/25	B-25/12/25		
				C-19/12/25	C-26/12/25		
11	**CO5**	**LLO 13.1**	* Determination of density of hazardous waste.	A-24/12/25	A-31/01/26		
				B-25/12/25	B-01/01/26		
				C-26/12/25	C-02/01/26		
12	**CO1**	**LLO 14.1**	*Measurement of air quality index of five different areas of your city on the basis of national ambient air quality standards.	A-31/01/26	A-07/01/26		
				B-01/01/26	B-08/01/26		
				C-02/01/26	C-09/01/26		
13	**CO1**	**NA**	Determine the RSPM of Person Air Sampler	A-11/03/26	A-18/03/26		
				B-12/03/26	B-19/03/26		
				C-13/03/26	C-20/03/26		

- **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	High Volume Sampler. Flow Rate: 0.8 to 1.8 m3/min, Particle Size: Down to 1.6 micron depending upon Filter used, Blower: Continues duty blower with brushless Motor, Recommended filter: GF/A (8" X 10") for common use, EPM 2000 for Special Research or equivalent, Time Record: 0 to 99999.99 hrs. Time totalizer records the running time in hours, Timer: 24 Hrs Programmable timer, number of required intervals	1

	can be programmed, Power requirement: 220Volts, Single phase AC.	
2	Turbidity Meter. Range: 0 - 10,000 NTU Principle of Operation: Nephelometric Ratio (Color Correction): Full Time ON or OFF, Accuracy: ± 2% of reading plus 0.01 NTU (0 to 1000 NTU), Resolution:0.0001 NTU on Lowest Range, Response Time: less than 6 seconds, Sample Size: 30 ml, Light Source: Quick connect Infrared, Operating Temperature: 0° - 50°C, Air Purge: Connection for external dry air supply, Outputs: RS-232 Serial Port	10
3	Jar test Apparatus. No. of Jar (Stirrer options): - 6 Speed range: - 2 to 250 RPM (Made available in variable speed control) Timer: -Digital timer supports – 0 to 99 minutes Controls Keypad: - Touch-sensitive Digital Display: -LED, digital rpm indicator support Power: - 220 v ac supply, 50 Hz, 100 W Temperature: - 35 oC Accuracy: ± 2 RPM Size: - Standard and Customized Body: -Powder-coated body finish	11
4	Orsat Apparatus. Three absorption pipettes of two compartment type, 100 ml Gas Burette with outer jacket, Three Test Manifold with stopcocks, Aspirator bottle, for the analysis of CO, O2, CO2 particularly in fuel and furnace gases, Wooden cabinet with sliding doors.	2
5	PUC Kit. Leak Test: No, Technology Used to check the parameters: Electrochemical, Optional Sensors: Temperature, Number of Impringer: 1, Parameters to check - CO,CO2,HC,O2, Nox, Sox.,Standard Accessories: Sampling probe, Buttons: Soft Touch Keys, Display Type: LCD, Calibration tests Certificate: Yes.	3
6	Kjeldahal Apparatus. Heating mantle: - 6 Flask Capacity: -500 ml Structure: - Power coated MS Cabinet Temperature:- Ambient + 10 oC to 350 oC Heating element: - Nichrome heating element, Temperature Controller: - Energy regulator, Heating Surface: - Fiber glass net, Power Supply: - 220 V, 50 Hz, Optional: PID Controller.	4
7	DO meter. Range: 0-500%. Temperature: -5 oC to 55 oC. Resolution: 0.1 oC, Accuracy: ± 0.3 oC	7
8	COD Apparatus. Temperature Range: Above ambient to 180° C or higher, Temperature Resolution: 0.1° C, Display: Digital 12mm Red LED, Control: Digital Electronic Temperature Controller, Heater Rating: 750 Watts, Sensor: PT?100, Timer: Selectable 15, 30, 45, 60, 90 or 120 minutes with alarm, Hole Size: 38mm Diameter x 76mm Depth, Glass Tube: 36mm diameter, 06 no (2 x 3rows), Sample Volume: 20 ml Each, Overall size: 21 x 12 x 11", Net weight w/o packing: 21kilograms	8
9	BOD Apparatus. Temperature Range-5°C to 60°C, Temperature Accuracy- ± 0.5°C, Temperature Uniformity- ±1°C, Temperature sensor PT-100, Temperature Controller- PID temperature controller LED display of SV & PV, Construction Double walled with PUF Insulation, Inner Construction-Stainless Steel 304 grade, Exterior Construction Powder Coated GI sheet, Exterior Door Solid door with lock & key, Inner door-Glass door to view samples, Trays-Wire mesh cable trays(removable), Interior illumination LED Light, Heating Element-U-shaped SS tubular heaters, Refrigeration System CFC Free Compressor, Air Circulation Motorized Blower / Axial fan, Safety-Temperature High / Low alarm, Power supply-220 Volts 50 Hz	9
10	Weighing balance- Accuracy 0.1 mg to 500 gm	All
11	Glassware: Burette, Pipette, Conical Flask, Beaker, Measuring Cylinder, Specific gravity bottle etc.	All

- **References:**
- **Suggested Learning Materials / Books**

Sr. No.	Author	Title of Book	Publication
1	Rao, C. S.	Environmental Pollution Control and Engineering	New Age International Publication, New Delhi, 2015. ISBN: 81-224-1835
2	S.P. Mahajan	Pollution Control in Process Industries	Mc Graw Hill, New York, 2009, ISBN 9781118843727
3	Soli J Arceivala, Dr. Shyam R. Asolekar	Waste water treatment for pollution control and reuse	McGraw Hill Education (India) Private Limited, ISBN: 9780070620995
4	A D Patwardhan	Industrial Solid Waste	Teri Press, New Delhi, 2013,ISBN:9788179935026
5	Michael D. Lagrega,Phillip L. Buckingham	Hazardous Waste Management	Mc Graw Hill, New York, 2009, ISBN: 078-87-403-0363-6
6	Central Pollution Control Board.	Pollution Control Acts, Rules &Notifications Issued Thereunder	Central Pollution Control Board, ISBN: 978-2021152036.

- **Learning Websites & Portal**

Sr. No	Link / Portal	Description
1	https://ceerapub.nls.ac.in/wp-content/plugins/pdfjs-viewer-shortcode/pdfjs/web/viewer.php?file=/wp-content/uploads/2020/ 01/Handbook-on-Waste-Management-book.pdf&dButton=false&pButton=false&oButton=false&sButton=true	E-Book-Handbook on Chemicals andHazardous Waste Management and Handlingin India
2	https://www.nptelvideos.com/video.php?id=1936&c=11	Sources of air pollution
3	https://archive.nptel.ac.in/courses/123/105/123105001/	Fundamentals of Environmental pollution and control
4	https://archive.nptel.ac.in/courses/105/106/105106056/	Physiochemical Treatment of solid and hazardous waste
5	https://cpcb.gov.in	Analysis of air quality index.

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