

Maharashtra State Board of Technical Education, Mumbai
LABORATORY PLAN (LP)
Academic Year: 2026-27

K-2

Date: 30/06/2026

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

Class: SYCH

Program and Code: Chemical Engineering (CH)

Course Index: CO307

Course Name: Introduction to Analytical Instruments for Chemical Analysis

Course Code & Abbr.: 313017(IAIC)

Total Hrs: 30

Semester: III^d

Scheme: K

Name of Faculty: Dr. P. S. Bhandari

• **INDUSTRY EXPECTED OUTCOME**

The course should be taught and implemented with the aim to develop required skills in students so that they are able to acquire following industry outcome: The course is expected to develop an ability to select suitable analytical instruments, interpret the results obtained by using the analytical instruments thereby monitor and control the progress of process/operation.

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

CO307.1: Differentiate between different instrumental methods of chemical analysis as per requirement.

CO307.2: Select relevant Spectroscopy based method of analysis based on nature of sample.

CO307.3: Select appropriate chromatography based analytical instruments for the given analyte.

CO307.4: Interpret the results of thermoanalytical method to decide the thermal stability of a material.

CO307.5: Identify analytical instruments for composition and crystallographic study of a relevant sample.

• **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			
				CL	TL	LL					FA - TH	SA - TH	Total	FA-PR		SA-PR		SLA			
				Max	Max	Max	Max	Max			Min	Max	Min	Max	Min	Max	Min	Max	Min		
313017	Introduction to Analytical Instruments for Chemical Analysis	IAIC	SEC	2	2	-	-	4	2	-	-	-	-	50	20	-	-	-	-	50	

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, *# Online Examination, @\$ Internal Online Examination

• **Laboratory Learning Outcome (LLO)**

LLO No.	Title of LLO
LLO 1.1	Classify the analytical instruments.
LLO 2.1	List the different parts of UV- Visible Spectrophotometer.
LLO 2.2	Explain the working of UV- Visible Spectrophotometer.
LLO 3.1	List the different parts of Atomic Absorption Spectrometer.
LLO 3.2	Explain the working of Atomic Absorption Spectrometer.
LLO 4.1	List the applications of Atomic Absorption Spectrometer.
LLO 5.1	Interpret the graphical data.
LLO 5.2	Identify the appropriate sample for Chromatographic study.

LLO No.	Title of LLO
LLO 6.1	List the different parts of Gas Chromatograph (GC).
LLO 6.2	Explain the working of Gas Chromatograph (GC).
LLO 7.1	List the different parts of High Performance Liquid Chromatography (HPLC).
LLO 7.2	Explain the working of High Performance Liquid Chromatography (HPLC).
LLO 8.1	Describe methods of analysis of HPLC.
LLO 9.1	Differentiate the chromatograms of different samples based on the nature of the material.
LLO10.1	Explain the principle and applications of identified analytical instruments.
LLO 11.1	Differentiate spectrums of 5 compounds.
LLO 11.2	Differentiate chromatograms of 5 compounds
LLO 12.1	Explain the different thermoanalytical methods of analysis.
LLO 13.1	List the different parts of refractometer.
LLO 13.2	Explain the working of refractometer.
LLO 14.1	List the application of XRD analysis in industry.
LLO 15.1	List applications of various analytical instruments available.
LLO 15.2	Write specifications of identified instruments.
LLO 16.1	List the identified equipment along with specifications.

● **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	Batch	Planned Dates		Actual Date of conduction	Remark/ Assessment Date with Staff sign
					From	To		
1	CO1	LLO1.1	* Explain the classification of analytical instruments based on following points: a. Method / Criteria of classification b. Phenomenon underlying method c. Quantity or property measured	A	02.07.2026			
				B	07.07.2026			
				C	04.07.2026			
2	CO1	LLO2.1 LLO2.2	* Explain Principle, Construction, Working and Application of UV-Visible Spectrophotometer.	A	09.07.2026			
				B	14.07.2026			
				C	11.07.2026			
3	CO1	LLO 3.1 LLO 3.2	* Explain Principle, Construction, Working and Application of Atomic Absorption Spectrometer	A	16.07.2026			
				B	21.07.2026			
				C	18.07.2026			
4	CO1	LLO 4.1	Visit soil and water testing labs / research lab in your area and prepare a report based on applications of Atomic Absorption Spectrometer.	A	23.07.2026			
				B	26.07.2026			
				C	25.07.2026			
5	CO2	LLO 5.1 LLO 5.2	* Use a virtual lab to prepare a report on interpretation of graphical data of given sample by Paper Chromatography	A	30.07.2026			
				B	04.08.2026			
				C	01.08.2026			
6	CO2	LLO6.1 LLO6.2	*Describe the Principle, Construction, Working and Applications of Gas Chromatography (GC).	A	13.08.2026			
				B	11.08.2026			
				C	08.08.2028			
7	CO2	LLO7.1 LLO7.2	* Prepare a report stating Principle, Construction, Working and application of High Performance Liquid Chromatography (HPLC).	A	20.08.2026			
				B	18.08.2026			
				C	22.08.2026			
8	CO3	LLO8.1	Refer journal papers and prepare a report based on HPLC based method of analysis of identified 3-5 compounds.	A	27.08.2026			
				B	25.08.2026			
				C	29.08.2026			
9	CO3	LLO 10.1	* Refer NPTEL website. Prepare a report / presentation based on any one relevant instrumental methods of analysis.	A	03.09.2026			
				B	01.09.2026			
				C	05.09.2026			

PR. No	Relevant COs	Practical -Laboratory Learning Outcome (LLO)	Name of Experiments/Assignment/Sheet/ Job/ Project Activity	Batch	Planned Dates		Actual Date of conduction	Remark/ Assessment Date with Staff sign
					From	To		
10	CO4	LLO 13.1 LLO13.2	Use Virtual lab and perform experiments based on Abbe's Refractometer.	A	10.09.2026			
				B	08.09.2026			
				C	12.09.2026			
11	CO4	LLO 14.1	Refer Journals / Magazine / Online resources to prepare a report on application of XRD analysis in industry.	A	17.09.2026			
				B	15.09.2026			
				C	19.09.2026			
12	CO5	LLO15.1 LLO15.2	* Visit Analytical / research lab available in nearby locations and Collect the information of analytical instruments available and prepare the list of relevant instruments, their applications along with specifications.	A	24.09.2026			
				B	22.09.2026			
				C	26.09.2026			
13	---	---	Practical Beyond Syllabus	A	01.10.2026			
				B	29.09.2026			
				C	03.10.2026			

● **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

References: Suggested Learning Materials / Books

Sr. No.	Author	Title of Book	Publication
1	B. K. Sharma	Instrumental Method of Chemical Analysis	GOEL Publishing House, Meerut (India) ISBN -81-87224-98-3
2	Douglas A. Skoog F. James Holler Stanley R. Crouch	Principle of Instrumental Analysis	Cengage ISBN 9789353506193
3	P. C. Jain, Monika Jain	Engineering Chemistry	Dhanpat Rai Publishing Company, 17th Edition ISBN 978-9352160006
4	Gurdeep R. Chatwal and Sham K. Anand	Instrumental Methods of Chemical Analysis (5 th Edition)	Himalaya Publishing House ISBN 978- 9351420880
5	R.Gopalan R..K. Rangarajan K.P.S.Subramanian	Elements of Analytical Chemistry(3 rd Edition)	S. Chand & Sons ISBN: 978-81-8054- 765-2

● Learning Websites & Portal

Sr. No	Link / Portal	Description
1	https://nptel.ac.in/courses/103108100 https://www.youtube.com/watch?v=UHYfgwjE2i4	Introduction to the Modern Instrumental Methods of Analysis by Dr. J.R. Mudakavi
2	https://www.youtube.com/watch?v=R_tgHUUXiE4	Common Analytical Instruments
3	https://www.youtube.com/watch?v=O39avevqndU	Ultraviolet / Visible Spectroscopy (UV- Vis)
4	https://www.youtube.com/watch?v=P9iAV-x5y-w	The Science Behind UV Vis Spectroscopy: Everything You Need To Know
5	https://www.youtube.com/watch?v=uSG8ANBTaNO	Gas Chromatography- Explainer Video
6	https://www.youtube.com/watch?v=Wap9pQEN4gE	Atomic Absorption Spectroscopy (AAS) Explained
7	https://www.youtube.com/watch?v=UycPljfrnWo	Quickly Understand Gas Chromatography
8	https://www.petro-online.com/news/analytical-instrumentation/11/gr-scientific/water-content-determination-of-crude-oils- and-petroleum-products-by-coulometric-karl-fischer-titration/34652	Water Content determination of Crude Oils and Petroleum Products by Coulometric Karl Fischer Titration
9	https://www.youtube.com/watch?v=QHMzFUo0NL8	What is X-ray Diffraction?
10	https://www.iitk.ac.in/che/PG_research_lab/pdf/resources/TGA-DSC-reading-material.pdf	Thermal Analysis Thermogravimetry (TG) & Differential Scanning Calorimetry (DSC)
11	https://webbook.nist.gov/chemistry	NIST chemistry workbook

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